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HYDROTHERAPY

A WORK ON HYDROTHERAPY IN GENERAL
ITS APPLICATION TO SPECIAL AFFECTIONS
THE TECHNIC OR PROCESSES EMPLOYED
AND THE USE OF WATERS INTERNALLY

BY

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TO
Dr. William Osler,
REGIUS PROFESSOR OF MEDICINE AND STUDENT
OF CHRIST CHURCH, OXFORD,
AS A TOKEN OF THE AUTHOR'S REGARD

PREFACE

No modern text-book on a medical subject can appear as the complete product of a single mind. In the evolution of a medical work, especially one on hydrotherapy, we have an art and a science whose beginnings stretch back for two thousand years. The genealogy of such a work reaches through ages of empiricism to the great minds which gave medicine its earlier start—to Hippocrates, Galen, Celsus, Aretæus, Musa, Paulus Ægineta, and Oribasius. The Roman baths were one of the great features of that great empire, and were established in its most distant possessions. Only last year, A. D. 1909, in the ancient town of Bath, in England, there was a restoration of the Roman bath as it existed in the time of the Cæsars. The baths of Rome became so sumptuous, and entailed such extravagance, that they eventually lost their hygienic features, and contributed to the decay of the Roman character and bodily vigor, so that in the dark ages that followed the nobler uses of water were neglected. Only within the last two hundred years has light begun to reappear, and only within the last fifty years has a scientific system of hydrotherapy been evolved.

As the science exists to-day, supplemented by the use of modern apparatus, it is a powerful aid in therapeutics, rapidly growing in popularity as the knowledge of its technic becomes more widely diffused. It would be an almost hopeless task to give each writer credit for the introduction or description of particular hydrotherapeutic methods. References have been made in places throughout this work so that further studies may be made. For a bibliography one is referred to the first and second series of the Index Catalogue of the Surgeon-General's Library at Washington. A glance at this remarkable list shows

at once the great hold that hydrotherapy has in medical practice in Germany, Austria, and France. It is to be hoped that in America the growing practice of hydrotherapy and balneology may be guided along rational lines, and we believe that the profession and the public will eventually award it first place in physiologic therapeutics.

The medical profession in the United States owes a debt to Dr. Simon Baruch, of Columbia University, for advancing greatly the practice and teaching of hydrotherapy, and the author is under personal obligations to him for many suggestions.

While the author is a firm believer in using physiologic therapeutics wherever possible, he by no means wishes to exclude the use of drugs. Rational therapeutics calls for their use, but reference to them is necessarily omitted here. It is also true that many diseases are amenable to hydrotherapeutic treatment whose names are not mentioned, but the underlying principles are stated, and it remains for the practitioner to apply them, along with other remedies, for the improvement of the circulation, for enhancing the tone of the skin, for an effect upon the nervous system, or in any other way that moisture or heat or cold may be deemed useful.

In treating patients at spas, and especially those who have been sent away in the hope of completing a cure begun at home, great caution should be exercised in order to preserve harmony between the previous medical attendant and the one who assumes temporary charge of the case. Patients generally are willing and expect to relinquish much of their previous internal medication. This, however, is by no means always necessary. Indeed, the hydrotherapeutic measures adopted are often aided by medication, and it requires a nice estimate of their value in order that their aid should not be lost. This is most true in all specific cases, and here medication can be pushed to the point of greatest efficacy. Many of the ordinary drugs, however, which patients bring with them can be dispensed with.

A favorable mental attitude is a great help in all treatment;

patients who have traveled far for their cure are thereby relieved of most of the harassing features of their previous surroundings; they are impressionable and readily give themselves up to a well-chosen régime. As Dr. Luke says, the visitor in search of health cannot do better than lay to heart the old Roman inscription on the baths of Caracalla:

“Curae vacuus hunc adeas locum,
Ut morborum vacuus abire queas;
Hic enim non curatur qui curat”

“Light of heart approach the shrine of health,
So shalt thou leave with body freed from pain;
For here's no cure for him who's full of care.”

GUY HINSDALE.

HOT SPRINGS, VIRGINIA,
July, 1910.



Bath. The Roman baths.

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HYDROTHERAPY

GENERAL HYDROTHERAPY

THE RATIONALE OF HYDROTHERAPY

THE physical and chemic qualities of the water used in hydrotherapy must be understood. So, also, must we understand the anatomy and physiology of the skin, the nervous system, the heart, and circulation; in short, the remarkable impress which water in the various ways in which it is applied makes upon every function of the body. This agent derives its varied powers from its remarkable flexibility of administration. It is applied as a solid, a liquid, and as a vapor; it is used in its natural state either hot or cold, pure or highly mineralized; free from gas or more or less charged with carbon dioxid or sulphur dioxid; it may be applied in pools, tubs, jets, or sprays, and with or without pressure; in the quiet of the sick room or in the boisterous surf of the ocean. This capacity for infinite gradation, and its almost unbounded applicability to various pathologic states, justifies the claim, made with growing insistence, that the use of water commands the first place in modern therapeutics.

A glance at the list of hydrotherapy references in the catalogue of the Surgeon-General's Library, Washington, reveals a most voluminous literature. There are 32 columns and 640 references to the subject of hydrotherapy. No other single remedial measure can compare with it in its antiquity; no other method of treatment is so extensively employed in the modern world. The time is coming when this, as well as other physical

measures, will be utilized not alone in hospitals and sanitaria, but will become the common property of general practitioners.

Physicians now realize that by physiologic therapeutics much more can be done than by drugs; patients, also, demand from their medical advisers definite information as to climates, resorts, and the use of mineral springs, so that the broader the knowledge of these subjects by personal experience, the more valuable and more highly appreciated is the advice given. Resorts having a good climate with the additional advantage of hydrotherapy or of mineral baths are numerous in Europe and America.

One advantage that hydrotherapy has over balneology, or the use of mineral baths, is that it is possible to install complete hydrotherapeutic apparatus anywhere, provided we have a good water supply and means for heating and cooling the water. On the other hand, mineral springs, as employed in balneology, occur where nature has located them. Fortunately, the location of most of these resorts is very attractive. The most remarkable group of mineral springs in the United States is found in the Yellowstone National Park, a wonderland of beauty and sublimity. Undoubtedly the time is near when the mineral springs of the National Park will be utilized for balneologic purposes.

While many writers draw nice distinctions between hydrotherapy and balneology, the author fails to see any great difference, at least from the clinical standpoint. The two subjects are indissolubly connected; their effects on the human system are governed by the same laws; the results obtained are due much more to the physics of the process than to the chemistry of the medium employed.

In hydrotherapeutic applications the chemic analysis of the water, as regards mineral constituents, is a negligible quantity. The water is used as a means for conveying heat to the body or abstracting heat from it; it is the medium by which force or pressure is applied to the various parts of the body; by which an impress is made upon the circulation or other physiologic processes concerned in secretion and nutrition.

So with balneology. From time immemorial the mineral springs have been employed. The fame of Thermopylae (*θέρμης πύλαι*), a sulphur spring that has been in use in Greece for two thousand years, of Hieropolis and Philadelphia in Asia Minor, of Helouan in Egypt, Carlsbad, Baden-Baden, Aix-les-bains, Bath, the Aguæ Calientes of the Spanish American possessions, the Springs of Mt. Clemens, and the Hot Springs of Virginia, North Carolina, and Arkansas, rests upon something more than the chemic nature of the waters. Two thousand years of implicit faith in laboratory analyses has been challenged in these latter days by the "higher criticism" of the German and Austrian leaders in the field of modern hydrotherapy. Consider for a moment the well-founded reputation of the three great American resorts for the successful treatment of rheumatism, and the similarity of results in this particular affection, and then compare the chemic analyses of the waters, and see the enormous difference between these springs from the standpoint of chemic contents.

	Boiler Spring. Hot Springs, Virginia.	Average of Seven Springs. Hot Springs, Arkansas.	(Original Spring). Mt. Clemens, Michigan.
Silica	4.50	2.58	27.60
Potassium chlorid . . . . .	.53		
Potassium sulphate . . . . .	.68		
Sodium chlorid . . . . .	.58	.27	11,900.00
Sodium sulphate . . . . .	.19	.41	
Sodium sulphid . . . . .	.21		
Magnesium chlorid . . . . .	....	....	648.5
Magnesium bromid . . . . .	....	....	6.37
Magnesium carbonate	2.70	1.13	.70
Magnesium sulphate	6.04		
Calcium chlorid . . . . .	....	....	934.5
Calcium carbonate	18.63	8.32	.98
Calcium sulphate	1.82	....	100.50
Cu. in. carbon dioxid	24.60	4.71	5.80
Cu. in. hydrogen sulphid . . . . .	.10	11.92	40.
Total solids	43.00		13,653.32

The table shows that there is twenty thousand times as much sodium chlorid in the Mt. Clemens water as there is in the waters of Virginia Hot Springs; the former are heavily charged with hydrogen sulphid, while in the latter the gas is imperceptible, being present in only .1 cu. in. per gallon. The Hot Springs of Arkansas have comparatively little mineral content.

Here, then, we have three mineral springs, widely separated geographically, and varying greatly in the composition of the mineral contents, yet all three yielding satisfactory results in a given disease, *e. g.*, rheumatism.

No one denies that there is a difference in the sensations produced by bathing in fresh water and in salt water; or between bathing in a calcareous water and in a brine containing from 1 to 2 pounds of salt to the gallon; or that, in bathing in water highly mineralized and carbonated, considerably lower temperatures should be employed than in the use of fresh water or that which is very lightly mineralized. This principle is recognized in the administration of the Nauheim bath, the temperature of which is usually fixed at about 95° F. (35° C.), but any other effect than that on the peripheral nerve terminals, and thus modifying the response of the nervous system, is a matter which has not been established.

The question resolves itself into a single proposition: Are any of the mineral constituents absorbed through the skin of the bather while in the bath? Popular opinion and belief are strongly in the affirmative. The vested interests and their adherents at the various spas in Europe and America stoutly maintain that this is the case, and immediately ask how else we would explain the remarkable cures that have been observed during centuries of successful experience.

The question is a vital one, and deserves a candid and unbiased consideration. The fact that cures have been observed under any given method of treatment has not always been interpreted properly respecting the means employed. Credit has been given frequently to remedies, and particularly to drugs, that have in nowise aided in recovery. This has been the case for ages, and will always be the case with the present constitution of the human understanding.

It is interesting to see the explanation of the action of the waters of Bath, England, given by Dr. Robert Pierce, who practised for sixty years in that resort. In his work "History and

Memoirs of the Bath," published in 1713, he records a case of intermittent limp which he cured. He says:

"For it brought warmth and heat into the part, which it was altogether destitute of before; it took off the convulsive motions which were before frequent and violent (especially at night and when he was first falling asleep.)"

James Currie, who wrote one of the first and best books on hydrotherapy,¹ states that there is no increase of weight in the bath, and while the skin remains "sound and entire no absorption of solid, liquid, or aëriform elastic fluid takes place on the surface. In the instances that are supposed to favor the contrary opinion, it will be found that the article is forced through the epidermis by mechanical pressure, or that the epidermis has been previously destroyed by injury or disease." Currie refers to the experiments of M. Seguin,² which were made for the purpose of determining the question of cutaneous absorption. "He dissolved in the water of the bath; in which he made his experiments, substances which produce a specific effect when received into the system, by which their inhalation might be ascertained. He employed the oxygenated muriate of mercury³ in solution on a number of venereal patients, and, while the epidermis was entire, he never perceived a single instance of salivation or even of amendment of their complaints. But in cases where a considerable portion of epidermis was injured or destroyed, as in the itch, the specific effects of mercury on the system were produced. The experiments of M. Seguin are very numerous, and appear to be devised so as to meet every objection.⁴ He concludes from the whole that, while the epidermis is entire, the absorbents of the surface take up neither water nor air, nor any substance diffused or dissolved in either."

¹ Medical Reports on the Effects of Water, Cold and Warm, as a Remedy in Fever and Other Diseases, second ed., Liverpool, 1798, p. 264.

² Fourcroy, *La Médécine éclairée par les Sciences physiques*, p. 232; see also Appendix, No. III, Currie's treatise.

³ Bichlorid of mercury.

⁴ He also used solutions of antimony and potassium tartrate, muriate of ammonia and mercury, etc.

The explanation afforded by Dr. Pierce two hundred years ago, and by Currie, in the same century, of the *modus operandi* of the mineral bath met with vigorous local opposition, was not generally received, but it is fully substantiated by the modern school. Professor Heinrich Kiseh, of the University of Prague and of Marienbad, has formulated his views in a recent treatise on Mineral Waters and Their Uses,¹ as follows:

"That circumstances upon which, formerly, a particular emphasis was placed in estimating the value of mineral baths—namely, that the constituents of the mineral water employed for the bath were capable of exerting a direct influence by absorption into the blood—has been forced into the background by recent investigation. The question as to whether the uninjured human skin is capable of absorbing the substances dissolved in the water of the bath has been decided in the negative by recent thorough research. The results of earlier studies, apparently showing that increase in weight occurs after the bath, and that this is due to absorption of water, that the increase in the quantity of urine secreted after the bath is a result of the absorption of water, and, further, that after simple muriated baths there is an increase in the urinary chlorids, indicating a diffusion of the salt of the bath, have not been confirmed. . . . It is true that substances capable of injuring the horny layer of the skin—as, for instance, mercurie chlorid, arsenic, salicylic acid, salol—will, when added to the bath, be absorbed through the skin, and this appears not unimportant in connection with certain varieties of baths, such as peat-baths and mud-baths. Ethereal solutions, also, as those of atropin, cocaine, lithium chlorid, veratrin and aconitin, are, according to the experiments of R. Winternitz, absorbed by the skin. On the other hand, Winternitz found it impossible to demonstrate the direct entrance of these substances into the skin from watery solutions:

"It may, therefore, be considered as established that the uninjured human skin is not permeable to water and to indifferent

¹ A System of Physiologic Therapeutics, vol. ix, edited by S. Solis Cohen, Philadelphia, 1902.

substances dissolved in it, even after long-continued exposure, and that absorption of fixed constituents through the skin does not take place in mineral baths. The skin of the bather is probably, however, permeable by the gases and volatile constituents of the mineral water, as the author has demonstrated for carbon dioxid, and Röhrig, for hydrogen sulphid and illuminating gas."

Röhrig made some experiments as to whether iodin can be absorbed from the bath. He took special precautions to protect with fat the mucous membranes exposed in the bath, and respiration was carried on through a tube terminating outside the room. Although he remained for three-quarters of an hour in full baths, to which potassium iodid had been added, and that were maintained at a temperature of 95° F. (35° C.), no iodin appeared in the urine. Kletzinsky, Lehman, Thomson, Rabateau, Ritter, and others, according to Kisch, obtained similar negative results in experiments with baths to which soluble substances, such as potassium ferrocyanid, potassium nitrate, ferrous sulphate, and ferrous carbonate were added.

Stas¹ made similar observations on himself. On three successive days he subjected himself to baths of 86° to 90° F. (30° to 32.2° C.), containing 50 mg. of sodium arsenate to the liter. Though immersed for prolonged periods, not the slightest absorption was noted. The same results were obtained from baths of potassium iodid and other salts, which would have been easily recognized in the urine had they been absorbed.

Dr. Simon Baruch, who has given this subject close study for forty years, and has published an elaborate résumé of the literature bearing on the physiology of the bath, is in accord with these views, and in his comments makes it clear that these negative results do not militate against the general impression that such mineral baths are exceedingly useful and effective therapeutically, due in some measure to climatic and hygienic elements beside the local and general temperature effects. He clearly states that the heat or cold conveyed by the peripheral cutaneous nerves to the central nervous system, and thence re-

¹ La Presse Médicale Belge, 1886, No. 13.

flected through the motor tracts, is the really effective element in the mineral baths. The latter are aided by only such ingredients as stimulate the cutaneous nerves, *e. g.*, strong saline or carbonic acid gas constituents. Other mineral ingredients are indifferent in their effect upon the skin, and utterly incapable of entering the system by cutaneous imbibition. These are facts substantiated by exact experimentation—facts which must unsettle long-cherished ideas, and arouse a healthy skepticism in the minds of medical men, and induce them to trust more frequently to the thermic and mechanical effect of pure water, *i. e.*, hydrotherapy.

We are thus forced to the conclusion previously enunciated, that hydrotherapy and balneology go hand in hand, and that the mineral waters, the analyses of which are quoted with such particular exactitude unto the third or fourth decimal place of grains per gallon, are neither more nor less efficacious on that account.

On what, then, does the value of the mineral bath depend? First of all, it is cleansing, the more so as it approaches an alkaline reaction and an elevated temperature. The secretion of the sweat glands and the epidermal scales are removed, and this allows a more intimate contact of the water with the body.

Second, there is a stimulating effect on the skin produced by the chemicals dissolved in the water. These saline or gaseous constituents affect the peripheral nerves by tactile irritation, and thus produce effects on the circulatory and nervous system in a reflex manner. This is probably more definite when the irritation is produced by such gaseous contents as carbon dioxid. Next in order would be the action of the denser saline waters, and least of all, that of the mild, calcareous alkaline waters.

Third, the irritation, which, it must be borne in mind, means the effect of cold as well as of heat. This is by far the most important. It is obvious that the greater the departure from the normal temperature of the body, so much greater will be the thermic irritation of the medium used. The effects of heat and cold, as applied in baths, are very different. On applying heat

or cold to the skin there is a direct influence on the part, but indirectly and reflexly through the central nervous system there are far-reaching effects upon the circulation in distant parts. These reflex actions are of great importance therapeutically, and will be discussed in subsequent pages in connection with particular diseases and special forms of treatment.

In applying heat or cold proximally,—*i. e.*, between affected part and the heart—we attempt to control the circulation in the part, but to avoid the use of direct applications. We may influence the circulation in an injured hand by applying an ice-bag in the axilla or at the bend of the elbow, or we may apply cold compresses to the neck to contract the carotids and relieve a congestion of the brain. So, also, we may use heat derivatively by drawing blood away from the affected part. The hot foot-bath and leg-bath are familiar examples.

Fourth, the mechanical irritation occasioned by mud-baths, moor-baths, and any motion or pressure imparted to the mineral water in its application. If the water under pressure is distributed over the body of the patient in fine spray, it is quite possible that some of the contained minerals or gases may reach the interior of the body by inhalation. While the chemicals so absorbed would certainly be infinitesimal, the gaseous emanations from the mineral water may have a more appreciable influence.

Heat and cold are two conditions of the same force, caloric, and, with reference to the human body, mean, respectively, the intensity of caloric above and below 98.4° F. (37° C.) (Wood). Dry heat, when locally applied to the absolutely dry surface, may be borne as high as 340° F. (171.1° C.); in local applications it may be borne higher in the form of radiant heat, but the presence of the slightest moisture or oily application quickly results in a blister or burn at this or lower temperatures.

It is well recognized that a certain tolerance is established during successive applications, and this holds true for heat as well as cold. The healthy body may absorb heat to the extent of 3 or 4 degrees or more if confined to special localities.

In order to preserve a constant body temperature, whether exposed to heat or cold, all warm-blooded animals have two inherent faculties: One, a *physical regulation*, causing increased or diminished heat loss; the other, a change in metabolism which can increase the heat production or *chemic regulation*. These are independent of the protection afforded by clothing.¹

Physical regulation is controlled by processes in the skin, where cold produces contraction and a bloodless state. This contraction checks loss of heat by radiation, conduction, and water evaporation. The primary hypcremia, due to long-continued cold, is scarcely ever seen in actual practice. The secondary hyperemia, however, which follows the withdrawal of ice or cold, is well known, and when artificially obtained is termed in hydrotherapy the "reaction." Its appearance means increased heat loss and marks the end of the control by physical regulation.

In order to enhance the reaction in hydrotherapy the physical regulation may be prematurely interrupted by the application of cold after heat, by employing friction in the bath, and by using stimulating chemic substances, such as carbonic acid gas, various chlorids, etc., in the water. Great stress is always to be laid on a "reaction," and when baths differ much from the normal body temperature, it is highly necessary to secure it. The appearance of the reaction is not usually as well marked at the beginning of a course of bathing as in the subsequent baths, for the reaction can be cultivated or brought out as the skin is *trained* to react.

The reaction of the body occurs in consequence of both cold and heat, and it is this physiologic feature which determines the effect of hydrotherapeutic treatment. Both air and water may be used in this connection, but water is generally preferred because it has a greater specific heat and a greater coefficient of heat conductivity. Man is particularly susceptible to hydrotherapeutic effects. There is no natural protection, and the

¹ See Von Noorden, Metabolism and Practical Medicine, vol. iii, for a full discussion of this subject.

clothing which he wears makes him sensitive to temperature changes. In order to estimate in advance one's reactive capacity we must form a judgment of the sensitiveness of the body surface. Clothing forms a kind of habitual thermal zone about the body, the temperature of which has been shown by Winternitz to remain fairly constant at about 89.6° F. (30° C.).¹

It therefore follows that an ordinary bath must have a temperature of some degrees above or below 89.6° F. (30° C.) in order that a decided reaction may be obtained. A tepid bath, however, as low as 85° F. (29.5° C.) or as high as 95° F. (35° C.) may be followed by a reaction, provided we employ at the same time some mechanical stimulation, as, for example, by means of a douche or jet having some force of impact.

A healthy man plunging into cold water shivers and, after an involuntary pause in breathing, inspires very deeply. The skin becomes pallid, owing to the contraction of the unstriped muscle-fibers, and he may or may not show the phenomenon of "gooseflesh" or cutis anserina. The reaction, as we nearly all of us know by personal experience, may set in while one remains in the bath or as one comes out of it. This reaction is the common experience of sea-bathing, and is a *sine qua non* if it may be indulged in with safety.

The rapidity and degree of reaction for cold varies very much in different individuals. It is delayed in the weak and feeble, but develops early and rapidly in the robust, especially if they have been in the habit of taking cold baths (Weber).

That great generalizer in hydrotherapy, Prof. Winternitz, has formulated some of the principles regarding the reaction, which we may summarize as follows:

The secondary warming of the body is the surest sign and most marked symptom of reaction. This is recognized especially in alterations of innervation, circulation, and metabolism, depending on various factors.

¹ See Sir Hermann Weber and F. Parkes Weber, *Climatotherapy and Palneotherapy*, London, 1907, p. 305.

1. The absolute amount of heat loss. The reaction is greater, within moderate bounds, the lower the temperature; the greater the fall, so much greater will be the temperature of the reaction.

2. The more quickly the loss of heat occurs, so much the more quickly will the secondary increase of temperature take place.

3. The duration of the cooling procedure influences the secondary heat production. Long-continued and gradual heat abstraction is followed by a slow reactive temperature increase of moderate intensity; but short and colder water applications, while not abstracting so much heat, are yet followed by a good reactive increase of temperature.

The best reactions with the least loss of heat are generally obtained by cold applications of short duration, administered when the patient is hot (Weber).

4. The degree of body heat before the application of cold influences the reactive temperature increase. If the body is very warm, at first it reacts more strongly to cold.

5. A warm application previous to the cooling procedure increases the intensity of the reaction according to the individual's susceptibility to a stimulus.

6. A combination of cold with mechanical stimuli increases the reaction.

7. Whether the reaction is prompt or not depends more or less on what the subject does after the abstraction of heat. Rest retards, work and exercise heighten, the reaction.

8. The internal use of stimulants, especially alcohol, after the abstraction of heat promotes the reaction.

9. In general, the reaction, and the heat production as well, bear a direct relation to the thermic stimulus to the nerves. The stronger it is, the more intense is the result.

Excessively cold procedures can lead to a delayed and extreme or imperfect reaction. Febrile cases sometimes show this in the form of clamminess of the skin and in collapse. Such cases call for powerful mechanical stimuli. The organism usually

reacts to thermic and mechanical stimuli, when applied in proper dosage, toward either excitation or depression.¹

Dr. Simon Baruch, to whom we are greatly indebted for presenting hydrotherapy to the profession in an ardent and rational manner, has reconstructed the entire theory of reaction, and proved that the contention between Matthes and Winter-nitz regarding tonic reaction after cold was baseless, because their premise that the *arteries* of the skin contract under cold is false. If this were true, Matthes would be right that there can be no tonic dilatation of the arterial muscular coat—dilatation of arteries always is *atonic*, of course. Dr. Baruch has shown that the hyperemia *after* cold is due to filling, not of the arteries, which are too deep, but of the *capillaries* (arterial), after having been emptied by the constriction of the unstriped muscular fibers which abound in the skin—that the sudden narrowing of the peripheral capillaries by this muscular contraction, together with the vasomotor stimulus, produces an enhancement of the ventricular contraction which drives arterial blood in abundance to the arterial capillaries which had been previously more or less emptied by the muscular constriction to which the cold has subjected them. This warm afflux, slowly or rapidly, according to previous duration and intensity, removes the constriction, and thus the capillaries are permitted to fill as the barrier is removed; the ventricular activity continuing, forces more and more blood into these capillaries, which, *having no muscular coats*, dilate as far as the normal contractility of the cutaneous muscular structures admit. The latter continues to offer a barrier to further distention, and in this wise is the tone at the periphery maintained—tonic reaction.

Dr. Baruch has explained the *atonic dilatation* after warm procedures by the same anatomic and physiologic facts. Here there is little if any primary vasomotor action. The warm bath *relaxes* the cutaneous muscular structure; the skin looks sodden and cyanotic as an evidence of this relaxation. The capillaries

¹ This subject is thoroughly treated by Prof. W. Winter-nitz in his Physiologische Grundlagen der Hydro- und Thermotherapie, Stuttgart, 1906.

dilate because there is diminished resistance; the latter weakens the cardiac action; the heart compensates by increase of the number of contractions for the imperfection of its systole; the local as well as the general circulation becomes enfeebled; there ensues diminished arterial tension, compressible pulse, etc.—we have *atonic congestion*. Hence the judicious cold bath is tonic or stimulating, while the judicious warm bath is atonic and sedative, demonstrating the flexibility of water as a remedial agent.¹

Chemic regulation has an equally valuable influence in physiology. It depends largely on the state of nutrition, the type of diet, and the size of the individual. It is interesting to note that chemic regulation is always accompanied or called forth by muscular activity. If one exercises the will sufficiently to avoid shivering or any other movement, then physical regulation alone is manifested. This subject expands rapidly, and the reader is referred to von Noorden's monograph and the work of Speck and others.² (See also pp. 37, 38 for a further discussion.)

PHYSIOLOGIC ACTION OF SALINE BATHS COMPARED WITH FRESH-WATER BATHS

Starting with the assumption that possibly saline baths exert a different action on the organism, Dr. Theodore Groedel II made a great number of experiments bearing on this matter under the direction of Professor Rieder in the Centralbad of the Munich Clinical Institute.³

Experiments were made on the respiration, pulse, blood-pressure, and body temperature in fresh water as well as with baths containing sodium chlorid, potassium chlorid, and calcium chlorid of known concentration. The subjects were young men of twenty to twenty-four years, who were placed for half an hour in the same attitude, in an empty tub, as in the subsequent bath. They were covered with a sheet and the necessary instruments

¹ Personal communication to the author.

² Speck, Die Physiologie der Atmung, 1892, p. 173.

³ Berliner klinischer Wochenschrift, March 13, 1905.

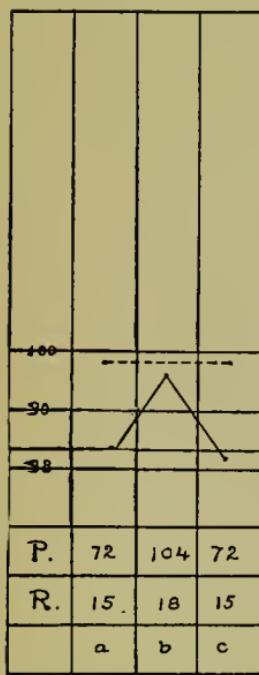
were in place. Just before the beginning of the bath careful observations were made. The temperature was taken in the mouth; the blood-pressure was taken with the Riva-Rocci sphygmomanometer; two competent observers were assigned to note the disappearance and reappearance of the pulse, so as to eliminate any personal factor. The rate of the pulse was recorded through a minute, and the respiration noted by a water manometer, provided with a thin rubber tambour attached to the breast by a bandage. The tubs were then filled without any disturbance of the subjects, and measurements were taken for five minutes and repeated in five minutes. The apparatus remained unchanged in position during the entire period of the experiments, so that the readings were made under similar conditions.

The baths were previously arranged so that they consisted of pure fresh water, salt water in strength of 3, 4, 5, 6, 7, 8, 9, and 10 per cent., potassium chlorid 4 and 8 per cent., and calcium chlorid 4 and 8 per cent. The atmospheric temperature of the bath-rooms was maintained at 20° C. (68° F.), that of the baths at 35° C. (95° F.), which is an accepted standard for the indifferent bath.

A slight loss of *temperature of the water* of the bath was noted; without the subject in the bath it amounted in fifteen minutes to about .4° C. (.7° F.); with the subject, it varied between .3° C. (.5° F.) and .5° C. (.9° F.). The *body temperature* fell in the fresh water between .1° C. (.18° F.) and .2° C. (.4° F.), and in the salt baths to .3° C. (.5° F.). The *respiration* record gave a variation of —1 and +1 in the fresh water and —4 and +4 in the salt baths. The *rate of the pulse* was not, on the whole, affected when the salt baths were compared with the fresh-water baths; the extreme changes noted in the salt baths were +4 and —8. The *blood-pressure* was altered from 0 to +3 mm. Hg. in the fresh-water baths and from —10 to +19 in the salt baths, the higher readings being obtained with the 10 per cent. sodium chlorid and the calcium chlorid baths. It was evident from these careful observations that the body temperature, the frequency of the pulse, and respiration were practically the

same in the fresh-water as in the saline baths; while in the latter the blood-pressure was both increased and diminished. Robin found that *nitrogen elimination* was increased by salt baths, while Keller found it to be diminished.

In the case of the Turkish bath exposure of the same man to a temperature of 122° F. (50° C.) for fifty minutes in the drier air raised the axillary temperature only 1.2° F., the pulse 32



Temperature Effect of Turkish Bath

The continuous line represents temperature in the axilla. The dotted line, temperature in the rectum.

	Day before bath.	Day of bath.
Quantity of urine.....	1567 cc.	950 cc.
Specific gravity of urine.	1018.8	1027
Urea	45.47 gm.	39.90 gm.
Uric acid .....	.683 gm.	.860 gm.

Fig. 1.—Turkish bath, temperature 122° F. (50° C.): *a*, Body temperature before entering the bath; *b*, temperature fifty minutes after entering the bath; *c*, temperature twenty minutes after leaving the bath when in the cooling chamber. *P*, pulse; *R*, respiration.

beats, and the respiration only from 15 to 18 per minute. The rectal temperature was not altered. There were less marked changes in the quantity and density of the urine; the increase of uric acid excretion was about the same.

Frey and Heiligenthals made careful experiments on a healthy man exposed for twenty-five minutes to the saturated air in a Russian bath. The temperature was maintained at 113° F.

(45° C.) and the following changes were noted: The body temperature was raised from 98.4° F. (36.9° C.) to 103.4° F. (39.6° C.); the pulse rose from 72 to 136; the respirations, from 17 to 23. The urine, which for three days before the bath had averaged daily 1683 cc. of specific gravity 1021, was reduced

Temperature Effect of Russian Bath

The continuous line represents temperature in the axilla. The dotted line, temperature in the rectum.

	Day before bath.	Day of bath.
Quantity of urine.....	1683 cc.	900 cc.
Specific gravity of urine	1021	1027
Urea	52.68 gm.	38.7 gm.
Uric acid .....	.858 gm.	.980 gm.

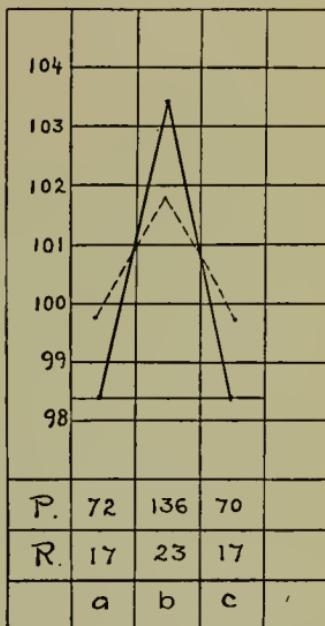


Fig. 2.—Russian bath, temperature 113° F. (45° C.): *a*, Body temperature before entering the bath; *b*, temperature twenty-five minutes after entering the bath; *c*, temperature ten minutes after leaving the bath; *P*, pulse; *R*, respiration.

in quantity to 900 cc. on the day of the bath and had a specific gravity of 1027. The urea was diminished by one-quarter and the excretion of uric acid rose 14 per cent.¹

INFLUENCE OF BATHS ON METABOLISM

This is a most complex and little-understood subject, but it is generally appealed to in explaining the good results obtained by hydrotherapy. Physiologic chemistry has now reached a stage of development far beyond the comprehension of all except

¹ See Stevenson and Murphy, Hygiene, Article by Hale White, vol. i, p. 641.

special students and laboratory experts. It remained for von Noorden to undertake the heroic task of coördinating the immense mass of literature on this subject accumulated during the last ten or twelve years. In his third volume, written in conjunction with Dr. Carl Dapper and Dr. Max Matthes, he has presented some of the more recent scientific work, referring, meanwhile, to the "enormous output of worthless pseudoscientific writings which mislead the inexpert. A clamorous jargon has been invented, which includes apparently learned expressions about delayed or increased metabolism, oxidation, assimilation, protein balance, molecular disintegration, ions, osmosis, radio-activity, and the like."¹

EFFECT OF COLD BATHS ON METABOLISM

Tissue changes brought about by cold baths are caused by an effect on the innervation of the muscles; in fact, all combustion processes in the body are referable to the muscles. A simple hot-air bath may have little effect, but a series of hot-air or hot-water baths increases nitrogen elimination, urea elimination keeping pace with the excretion of nitrogen, and uric acid is also excreted in greater quantity.

Elaborate studies of these metabolic changes have been made by many observers and in connection with ordinary hydriatic procedures, the half-bath, the Scotch douche, etc. It is interesting to note that Hippocrates² states that the temperature elevation which occurs in connection with most acute infectious diseases is, within limits, remedial in purpose and effect. It apparently follows that temperature-elevating baths may be beneficial in aiding resistance to infection, especially when followed by a short cold bath, by favoring the production of alexins and antitoxins. It seems to us, however, that cold baths are better, practically, in the infectious fevers—witness

¹ Max Matthes, of Cologne, has contributed an excellent review of this subject with 114 modern references to European literature in von Noorden's *Metabolism and Practical Medicine*, vol. iii, chaps. viii, ix, London, 1907.

² System of Physiologic Therapeutics, edited by S. Solis Cohen, vol. ix, p. 250.

the brilliant results obtained by the Brand treatment of typhoid fever.

That baths of such obviously different character may lead to very nearly the same physiologic result is one of the seeming paradoxes of hydrotherapy. This is recognized in practice, for, if patients do not react well to the cold bath in typhoid, it is Dr. Wilson's practice at the Jefferson Hospital in Philadelphia to give them a bath at 110° or 112° F. (43.3° or 44.4°C.). A patient convalescent from long illness complained to Dr. Sidney Ringer that he feared he could not resume his usual cold morning bath. "Never mind," said he, "take a hot one." He did so, having the water very hot and remaining in the bath only a short time. This procedure he carried out every morning for several years after the illness. The stimulating effect was produced, whether the baths were hot or cold.

Dr. Simon Baruch explains this seeming paradox by the physiologic fact that both heat and cold are thermic irritants which, briefly applied, excite the peripheral sensory terminals and thus stimulate. The secondary effects differ decidedly if the application be prolonged.

The effect of the *Nauheim bath* on metabolism would naturally be expected to be most pronounced, consisting, as it does, of solid and gaseous elements in large quantities. Improved assimilation and tissue metabolism is evidenced by formation of fresh muscular substance. The area of the dilated heart is diminished, but its power and true volume are enhanced. Superfluous fatty tissue and inflammatory residual products disappear; effete products are eliminated, and a loss of weight is commonly noted at the outset; but more substantial evidences of constructive metabolism begin to be noted, and continue long after the patient ceases to take the course of treatment provided in accordance with this system of hydrotherapy.

Dr. Paul Franze, of Bad Nauheim,¹ corroborates many other

¹ The Physiologic Action of the Nauheim Springs and the Indications for their Use in Circulatory Disorders, Jour. of Balneology and Climatology, July, 1904

observers in this particular. He says: "Tissue metabolism is accelerated as in cold fresh-water baths, only more pronounced, and it is relevant to mention that researches as to the physiologic action of chalybeate baths, rich in carbonic acid, show that this gas chiefly promotes the metabolism of non-nitrogenous matter, while excreted urea is diminished relatively to its intake. Practically, this means that while our baths reduce superfluous fatty tissue, they facilitate the formation of healthy muscular substance. This, of course, is especially applicable to the effervescent Sprudel baths. The acceleration in tissue metabolism, aided as it probably is by osmosis, promotes the absorption of exudations in the joints and pelvic and serous cavities. Nauheim baths are among the most efficient means of abolishing the residues of rheumatism and gout, of serous inflammations, such as pleurisy and pericarditis, and of inflammatory conditions of the adnexa of the female genital organs."

Turkish baths tend toward a gain in weight, but if the heating process is shortened, and cold water is applied liberally in connection with the plunge, the subject loses, because the loss of heat has to be made good by increased catabolism in the tissues.

The latest American studies of the effects of such measures on metabolism, as shown by an analysis of the urine, are those by Dr. Otto Folin and Dr. George T. Tuttle, of Waverly, Massachusetts.¹

Nine subjects, including mental patients of good physique and nurses in the McLean Asylum, at Waverly, were given a uniform diet adapted to the capacity of the individual, containing a known amount of nitrogen. After this diet had been continued for two days the urine was collected for each twenty-four hours and subjected to an exceedingly careful analysis. After three or four days baths were given about as follows:² Hot-air cabinet, 174° to 190° F. (78.9° to 87.8° C.), to perspiration; circular douche, 95° F. (35° C.), twenty seconds; pressure, 26 pounds; fan douche, 85° to 75° F. (29.5° to 23.9° C.), twenty-five

¹ Amer. Jour. of Insanity, October, 1904.

² For technic see p. 252.

seconds, 26 pounds; jet, 65° F. (16.3° C.), five seconds, 20 pounds. The treatment was varied for individual cases. These studies, contrary to expectation, failed to show any metabolic changes, although most carefully worked out on the basis of urinary excretion. The thought arises that there may have been other evidences of altered metabolism beside those shown by urinary analysis. These treatments were too brief to produce "evidences of altered metabolism," and there was not sufficient alternation of temperature. Beginning with 95° F. (35° C.) it was gradually reduced in the course of fifty seconds to 65° F. (18.5° C.). Baruch's hydrotherapeutic law, that the intensity of effect is in proportion to the temperature difference between water and skin, came into action here. The skin being gradually cooled down does not present the temperature contrast demanded for effects upon the metabolism. The general records showed a gain because the treatment was gently stimulating or tonic, increasing appetite and enhancing hæmostasis. The flexibility of water is demonstrated in the different results from different procedures. Dr. Baruch has pointed out this flexibility with emphasis not given to it by any previous authority, and he has offered a rational physiologic basis for every procedure, removing all apparent paradoxes. Patients free to eat and exercise at will during hydrotherapeutic treatment will, no doubt, gain. The general records of the McLean Hospital show that of 216 consecutive insane cases treated with similar baths, and on the usual diet, 168 gained in weight and 48 lost. The gain was from $\frac{3}{4}$ to $33\frac{3}{4}$ pounds, and the loss from $\frac{1}{2}$ to $22\frac{1}{2}$ pounds.

The experiments of Otto Pospischil, an assistant of Winter-nitz, show that the rate of heat production is increased in the cold bath by vigorous rubbing by as much as 44 per cent., and this may to a great extent diminish the temperature.

Short cold shower-baths increase heat elimination from 25 to 66 per cent., even more if mechanical friction be carried out. He also found the flow of respiratory air to be increased nearly three times in the half-bath. Increased vigor is undoubt-

edly the result of the procedure, but it should be remembered that if the water be at the higher temperatures, as from 80° to 90° F. (26.7° to 32.2° C.), a corresponding increase in the friction is required to produce good circulatory reaction. By raising the temperature of the water and communicating heat to the body, distinct effects on metabolism are produced. Carbon dioxid is exhaled at a much more rapid rate, and this is also true of the application of cold water.¹

Great differences in the reaction to cold baths are noted at different times in the same individual. Jurgensen relates the case of a man in good health who showed no fall of temperature in or after a bath at 9° C. (48.2° F.), lasting twenty-five minutes, but four days later, in a similar bath under the same conditions, his temperature fell to 33.9° C. (93° F.).

The lower the temperature of the bath the more vigorously heat production and heat loss proceed; also, during the first minute in the bath the organism gives off more heat than in the next, and, finally, in cold baths, after a certain variable period of heat loss, the rate becomes constant.

In a bath at 17.1° C. (62.8° F.), lasting two and one-half minutes, the heat production was fourteen times the normal. The subject had expended 64.63 calories and was himself .03° C. (.08° F.) warmer. It is an interesting point that of these 65 calories 43.76 were given off in the first minute and the remainder in the following one and one-half minutes.

In another experiment, lasting fifteen minutes in a bath at 26.75° C. (80.25° F.), the heat loss in the first five minutes was 43 calories; in the second five minutes, 15 calories; in the third five minutes, 17 calories.

Ignatowski² found that if no reaction occurred, the heat loss, by radiation, conduction and evaporation, continued to decrease even after the bath, while heat production was lessened. This

¹ Confirmed by experiments of Liebermeister, Goldscheider, Roehrig, Zuntz, and Strasser.

² Ignatowski, Der Warmehaushalt des Menschen nach Bädern und Duschen, Archiv für Hygiene, 51, 320, 1904.

latter was directly proportional to the degree of cooling reached, and his subjects were really cooled down by the cold baths. If, on the contrary, a prompt reaction set in, the diminished loss by radiation and conduction could scarcely be observed and that due to evaporation rose abnormally.

Rubner made some studies of short cold douches and baths under ordinary conditions of life:

Time, three to five minutes.	Douche.	Bath.
	16°C.(60.8°F.).	16°C.(60.8°F.).
Increase of respired air.....	Per cent.	Per cent.
.....54.5	.....22.9	
Increase of CO ₂ output.....	.....149.4	.....64.8
Increase of O intake.....	.....110.1	.....46.8

Baths of this kind affect favorably energy and fitness for work. Short cold baths, in which actual heat loss is small, cause a fairly marked increase in chemic metabolism just like the longer ones, only there is a less heat deprival, due directly to the movements which the baths set up. The heat production due to muscular activity exceeds and obscures the catabolism due to cooling, or in practice renders it quite negligible, except under very unnatural conditions. It is impossible to determine the extent of this increased catabolism accurately, because no method can be devised which will deal with muscular activity alone.

Shivering and active movements in connection with cold baths are thus natural aids in the regulation against cold; they produce heat, favoring and calling forth chemic regulation, and usually fully compensate, or may overcompensate, the heat loss.

If the heat loss in a healthy and moderately fat man is estimated during a period of fifteen to twenty-five minutes, it will be found that in a bath at 40° C. (104° F.) the heat loss is normal, in a bath at 30° C. (86° F.) it is almost doubled, and in a bath at 25° C. (77° F.) is tripled, and reaches five times the

normal at 20° C. (68° F.) (Liebermeister). Rubner made the following experimental study:

Effect of bathing on heat production. Duration of bath, one hour.	Temperature of bath.				
	15° C. (59° F.).	20° C. (68° F.).	25° C. (77° F.).	30° C. (86° F.).	35° C. (95° F.).
Heat production in calories.....	480	370	240	150	80
Heat + 18 calories for heat loss in respiration.....	498	388	258	168	98
Heat — 91 calories, which a man of 60 kg. normally produces.....	407	297	167	77	7
Absolute value of cooling of the bath.....	81	57	34	12	
Metabolism in the bath reduced to grams of fat.....	43	31	18	8	0.7
Metabolism in bath. Total effect and after-effect.....	52	37	22	9	0.7

For a bath lasting fifteen to thirty minutes the values for heat production must be halved. The "cooling" figure remains the same if the time is not shorter than fifteen minutes. "The effect of cold water on the body surface of a healthy man under normal conditions during a long-continued application does not lessen the body temperature at all; in many cases it even raises it" (Liebermeister), so that within limits the heat loss may be at first overcompensated.

Cold, *per se*, reduces the oxidizing capacity of animal tissues. Warmed tissues have a much higher oxidizing capacity. In order to maintain a constant normal temperature, we are compelled in the presence of cold to call more vigorously than usual on our heat-regulation powers so as to increase our oxidative activity. Hence in eclampsia we should resort to the use of heat.

Rubner¹ has found that in an experimental guinea-pig the metabolism at 0° C. is two and one-half times that at 30° C. Rubner also showed that a bath at 16° C. increased the oxygen absorption 46.8 per cent., and a douche at 16° C. increased the oxygen absorption 110 per cent.

¹ Energiegesetze, 1902, Ditman and Walker, N. Y. Med. Jour., May 15-June 5, 1909; see also Matthes, Lehrbuch der klinischen Hydrotherapie, Part i, Chapter iii.

QUANTITATIVE ESTIMATION OF THE AMOUNT OF THE HEAT LOSS. HEAT REGULATION.

This has been estimated under various conditions in numberless experiments by Prof. Winternitz according to methods fully explained in his various works, particularly in his last publication, *Physiologische Grundlagen der Hydro- und Thermo-therapie*.¹ Briefly stated, it is as follows:

1. Displacement of the blood and arresting of the circulation in a limb with an Esmarch bandage lowers the heat production 70.6 per cent.
2. Restriction of the circulation by passive hyperemia, Bier method, lowers the heat production 46.2 per cent.
3. Mechanical stimuli increase the heat production 95 per cent.
4. Weak chemical stimuli are able to raise the heat production as much as 40 per cent., while strong chemical stimuli may lower it 8 per cent.
5. Thermic influences, such as cause cutis anserina (gooseflesh), lower the heat production as much as 44.5 per cent.
6. A warm rain-bath, by production of gooseflesh, can cause lowering of heat production by 38.7 per cent.
7. Partial cold wet rubbing, or a partial application of the drip sheet, can increase the heat production by 80 per cent.
8. A cold rain-bath followed by rest on a couch produces, after a slight lowering of the heat production, an increase to 23 per cent.
9. A cold rain-bath followed by exercise can raise the heat production 66.6 per cent.
10. A warm rain-bath with a cold fan douche, followed by rest on a couch, can raise the heat production by 16 per cent.
11. In febrile diseases in the presence of rising body temperature the heat production may be lowered 25.4 per cent.

This is better shown in Fig. 3.

Cold applications have a *good moral effect in cultivating will power*. While the effect of such stimulations may be for a

¹ Stuttgart, Verlag von Ferd. Enke, 1906.

time unpleasant, particularly at the outset, the patient soon feels their benefit and is encouraged to continue them. Encouragement, suggestion, firmness, and kindness from the attendant and the personal interest and presence of the physician will do much at this stage to secure the coöperation and confidence of the patient and his continuance in the prescribed method of treatment. Physicians do not always realize the mental anguish which some poor creatures undergo when they begin a new and what appears to them a formidable course of hydrotherapy.

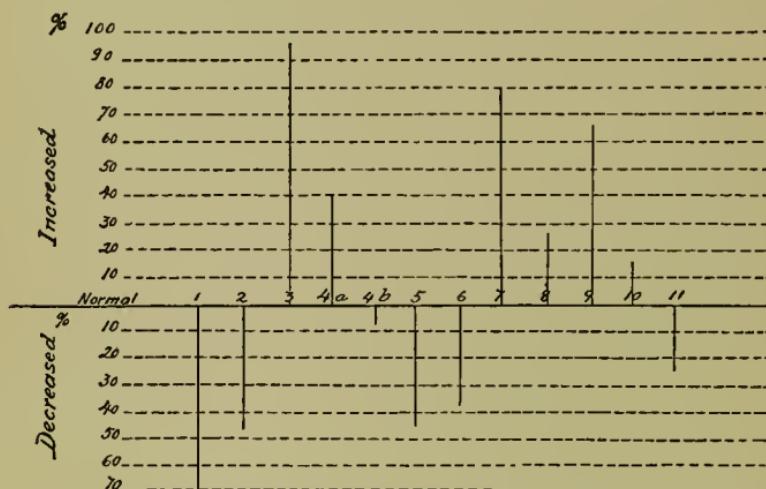


Fig. 3.—1, Esmarch bandage; 2, passive hyperemia; 3, mechanical stimuli; 4, *a*, weak, and *b*, strong, chemical stimuli; 5, cutis anserina; 6, warm rain-bath and cutis anserina; 7, partial rubbing (cold water); 8, cold bath and rest; 9, cold bath and exercise; 10, warm rain-bath; cold fan douche and rest; 11, active fever.

Some patients are hopeful and confident, others are apprehensive and distrustful.

Dr. Baldwin, of Boston, relates that one of his patients, who had long felt unable to do anything by reason of fancied weakness, went to the baths taking with her a sheet so that she might be properly wrapped up when they brought her dead body home. But kindly management gave her confidence and the baths which she took so improved her condition that health and activity were restored. As Baldwin says, "Cases of mental depression derive

much benefit from the baths; neurasthenic and psychasthenic patients are very likely to derive benefit from hydrotherapy, but they usually expect miracles, and that, too, without effort or anything disagreeable on their part. So it is that the doctor must insist on having his directions carried out. It is simply a question of whether the doctor will run the case and cure the patient, or whether the patient will continue to do as he pleases and run the doctor until such time as he dismisses him as an incompetent person. Dr. Baldwin¹ wisely remarks that these patients must be made to do something else than to sit around bemoaning their condition, and bathing is useful in occupying their time; they derive at the same time the benefit of the baths in the way of improved circulation and improved processes of metabolism. The baths take the patient completely out of himself for the time being, and though the patient does not usually like the bath, he feels that something active is being done for him. In different cases a good deal of personal persuasion is required until a reasonable attitude is assumed by the patient toward the prescribed treatment. Of course, in institutions a better control of the patient obtains than in attempting treatment in private practice. At the McLean Hospital at Waverly, Massachusetts, Dr. Tuttle had a patient who was possessed with the delusion of demoniacal possession, and after realizing that he was being improved wrote this: "Your baths are excellent to reduce cerebral excitement. You can't fight the devil with fire, he is in his element there, but he is mortally afraid of cold water."

Undoubtedly, cases will present themselves in which it is impossible even for those of experience to foretell what the effect of hydrotherapeutic measures will be. Especially is this true in disorders of psychic origin or when patients are sent by physicians who have been familiar with their history to other physicians who may not know the idiosyncrasies and peculiarities of the patient thus despatched to a sanitarium or health resort. Patients must be studied individually in the light of a full letter of advice, and time must be taken, with moderate procedures, to

¹ Boston Medical and Surgical Journal, April 15, 1909.

arrive at a proper estimate of the best course to follow. Dr. George Beard, in condemning routine methods, wisely said: "If two cases are given the same treatment from beginning to end it is probable that one of them has been improperly treated." Dr. Pratt, in cases of doubt, has sometimes followed Binswanger's method in giving three different treatments on three successive days. After these have been repeated once or twice the treatment which seems to the patient to be most beneficial is selected. Usually one of the procedures will be condemned and one favored. In this way the support and confidence of the patient is gained.

The following sample outline of treatment is given as a suggestion:

First day: Electric-light bath, five to ten minutes, followed by wet mit friction.

Second day: Carbon dioxid bath (one-half full strength), ten minutes.

Third day: Wet pack, duration forty-five minutes to one hour.

Repeat treatments in the same order on the fourth, fifth, and sixth days.

Dr. Pratt advises that half an hour to an hour of physical and mental rest should follow each treatment, unless the patient is robust and with good reactive powers, when a brisk walk may be substituted. Often it is a good idea to combine rest and exercise by having the patient dress quickly, walk a certain distance, and on reaching home rest in bed for thirty minutes to an hour. A good proportion of the neurasthenic patients wish to discontinue treatment after the first or second bath has been taken. In many neurasthenic women a feeling of exhaustion comes on a short time after the treatment and persists the remainder of the day. This is usually regarded both by physician and patient as evidence that the hydrotherapeutic procedure has been too strong, but, as this temporary exhaustion develops after the mildest treatments and as it almost invariably disappears after the second or third treatment, the sensation of weakness is undoubtedly due in the great majority of cases to the

nervous strain of the visit to the institution. The surroundings are new and the appliances are strange and somewhat formidable in appearance. Dr. Pratt relates that he recently saw a patient in whom weakness and depression persisted until the sixth treatment. Since then she has felt refreshed and invigorated after the bath for the rest of the day. It was possible to prove beyond question in this instance that the weakness was of purely psychic origin because the patient felt as tired after a mild treatment (wet mit friction) as after a strong one (circular and horizontal douche).

Effect of Cold Baths (Brand Baths) on the Urine.—James Tyson measured the total daily amount of urine and the actual amount and percentage of urea excreted during an entire month by a patient who had typhoid fever and was treated by Brand baths, numbering 53 during the first two weeks. There was an increase in the urinary secretion, and on one day, early in the case after 5 baths had been given, 66 ounces (1980 cc.) were voided. An albuminuria with casts (*cloudy swelling*) disappeared during the treatment.

During hydrotherapy according to Brand's method the *toxic property* of the urine secreted is undoubtedly increased as contrasted with the urine in cases not tubbed. Ausset attributes the entire efficiency of the Brand baths to this active elimination of toxic agencies.¹

It is said that excessively cold procedures may produce hemoglobinuria and albuminuria. (For further discussion of this subject see pp. 238, 240.)

Albumin may be met with in predisposed persons after a cold bath, especially in the cyclic albuminuria of adolescence.

THE EFFECT OF HOT BATHS ON METABOLISM

In the case of hot baths there is no mechanism corresponding to the increased oxidation by which lack of heat is compensated for whereby the organism can reduce its heat

¹ James Tyson, Trans. Association Amer. Physicians, 1897; E. Ausset, Bull. et Mémoires de la Société Méd. des Hôpitaux de Paris, Tome 11, 3 serie, 1894, p. 825.

production or decrease its metabolism. When exposed to heat or when heat loss is prevented, the body temperature is governed only by physical regulation; that is, it is a question of evaporation; if this is checked, the body temperature necessarily rises. Winternitz showed that the increase in the consumption of oxygen caused by a moderately hot bath far exceeds that due to fever, and that there was a marked increase in metabolism, the carbon dioxid output and the oxygen intake going hand in hand; the heat balance being impaired, oxidation increases. It has also been shown that the body temperature can still go on rising for a short time after the end of a hot or vapor bath because the thoroughly heated skin must for a time continue to act as though it were still in the hot bath.¹ This, however, is adjusted in the course of an hour or two, and afterward a slightly subnormal temperature and a slight secondary rise has been noted.

This fall after hot baths might be expected to be greater than it is, considering the fact that the skin is left in such a highly vascular state. Winternitz, for example, found that the oxygen consumption in 1 case was increased by 28 per cent. even seventy-five minutes after the bath.

Comparing the effect of a hot bath at 44° C. (111.2° F.) and a cold bath at 16° C. (60.8° F.), Rubner found the increase of inspired air 18 per cent. in the former against 22.9 per cent. in the latter; the increase of carbon dioxid output was 32.1 per cent. in the hot bath and 64.8 per cent. in the cold; the increase of oxygen intake was 17.3 per cent. against 46.8 per cent. Repeated hot baths accentuate this metabolic change as compared with the results obtained from a single bath.

Hot baths, without the usual water-drinking, diminish the urine, since they promote sweating. Cold baths increase the amount of the urine temporarily. This, however, is usually quickly compensated for. The increased secretion depends on the raised blood-pressure due to cold.

¹ Speck, Ueber den Einfluss warmer Bader auf den Atmungsprocess, Deutsches Archiv für Klin. Med., 37, 1885.

Experiments show that as much as 1 quart of sweat may be lost in a prolonged hot-air bath. Dr. J. H. Pratt has noted a loss of 1500 gm. during an energetic hot-air bath, and it can be readily understood that this abstraction of fluid must affect the entire circulation of blood and lymph and undoubtedly aid in the elimination of morbid products. The abnormally high concentration of blood present in renal insufficiency can be reduced by sweating, and in these cases the low nitrogen content and the molecular concentration of sweat is thereby considerably increased. Reference will be made later on to the increased secretion of sweat in the elimination of various poisons, including lead, mercury, and bacterial toxins.¹

Uric Acid.—Both Formánek² and B. Laquer³ found that the excretion of uric acid was increased after hot baths. Formánek found also that a single cold bath is without effect, but that two long cold baths daily increase the uric acid output. Ebstein,⁴ however, claims that the uric acid excretion is not changed by the use of baths. In estimating uric acid excretion it may be considered as 10 per cent. of the total nitrogen eliminated, urea amounting to 85 per cent.

Sugar.--As for sugar, it has been found that when glycosuria has been produced artificially by administering large amounts of grape-sugar simultaneously with diuretics, free sweating suppresses the glycosuria and the sugar appears in the sweat. This is an experimental demonstration of the vicarious action of the skin which is occasionally noted in disease.

¹ J. H. Pratt, The Development of Scientific Hydrotherapy, Boston Med. and Surg. Jour., Jan. 25, 1906.

² Ueber den Einfluss Kalter Bader auf die Stickstoff und Harnsäureauscheidung beim Menschen, Zeitschr. für Physiol. Chem., Bd. 19, 271, 1894.

³ Ueber die Ausscheidungsverhältnisse der Alloxurkorper im Harne von Gesunden und Kranken, Verhandl. des 14th Kongr. für innere Medizin, 333, 1896.

⁴ Flechsig also states that the excretion of urea is diminished by carbonated baths.

TEPID, OR INDIFFERENT BATHS

have no effect on the metabolism. Salt baths at indifferent temperatures likewise have no effect, but when hot or cold they are more lasting in their metabolic effect than in the case of plain water at the same temperatures.

EFFECT OF BATHS ON BLOOD-PRESSURE

Every hot or cold douche calls forth an increase of blood-pressure, paradoxical as it may seem. Cold baths contract the capillaries of the skin; there is a slower but more vigorous contraction of the heart and consequent rise of pressure. Baths between 95° and 104° F. (35° and 40° C.) produce a primary rise, a secondary fall below normal, then a rise. Baths above 104° F. (40° C.) increase the pressure and also the pulse rate, the pressure remaining high. In baths accompanied by mechanical excitation the pressure is augmented, but returns easily to normal.¹

Carbonic acid or Nauheim baths between the temperatures of 84° F. (29° C.) and 89.6° F. (32° C.) do not lower a pathologic hypertension. Above the latter figures there is a marked fall, which, however, tends to rise even above the original tension after the bath; but this increase is not permanent.²

It follows that in the application of an agent which affects the blood-pressure so noticeably care should be taken not to aggravate any state of the system that cannot bear such an influence. We should carefully note any weakness of the heart or blood-vessels, so as to avoid any accident, for undoubtedly accidents have occurred through neglect of this precaution. Dr. Osler has said that longevity is a cardiovascular question. To a majority of men death comes primarily or secondarily through this portal. For that reason the greatest care should

¹ A full discussion of this subject is found in Dr. Baruch's Hydrotherapy, third ed., New York; also Therapeutics of the Circulation, by Sir Lauder Brunton, Phila., 1908.

² See Hürter, Zeitschrift für phys. und dietet. Therapie, Bd 12, 1908; see also Jour. Amer. Med. Assoc., April 23, 1910, pp. 1376, 1377.

be exercised at all times, but especially after middle life, to see that the circulatory organs are preserved and not weakened by sudden and unusual strain.

THE SPHYGMOMANOMETER

One of the aids in the recognition of hypertension is the spygmanometer as devised by Mosso, von Basch, Potain and Riva Rocci, and modified by Sir Lauder Brunton, C. J. Martin, Cook, Stanton, and Theodore Janeway. It is perfectly practical,

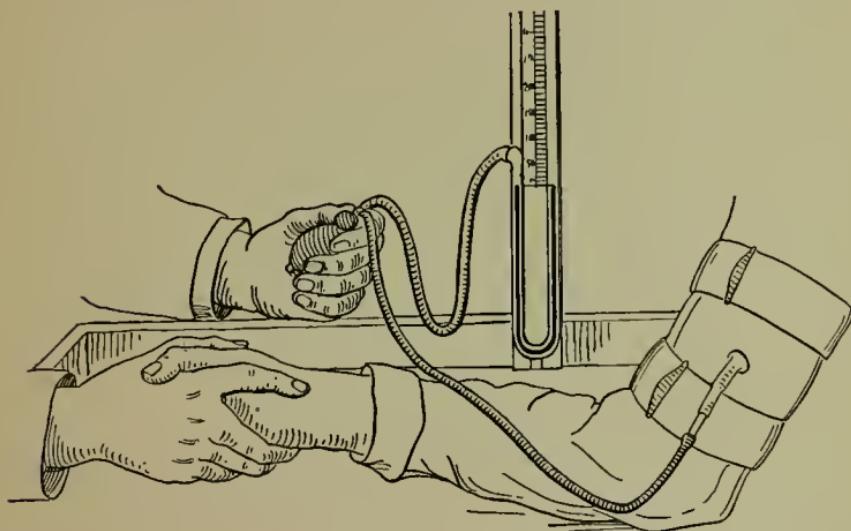


Fig. 4.—Dr. C. J. Martin's modification of the Riva-Rocci sphygmomanometer.

quickly used, and has been found of great value, supplementing the stethoscope in estimating the state of the vascular system.

In making a *sphygmographic tracing* of the pulse we can readily see the effect on the blood-vessels by the cold spray or bath. The pulse rate is slowed, the upward stroke is lessened, and the dicrotic wave is less pronounced. The tracings made by Marey, Sir Lauder Brunton, Bezley and Leslie Thorne, and W. H. Riley show this plainly. The upstroke is nearly vertical. It occurs during the dilatation of the artery and is produced by the systole of the left ventricle. The line of descent is gradual and corresponds

to the diminution in diameter of the arteries, and as it falls the dicrotism appears. The height of the up stroke indicates the force

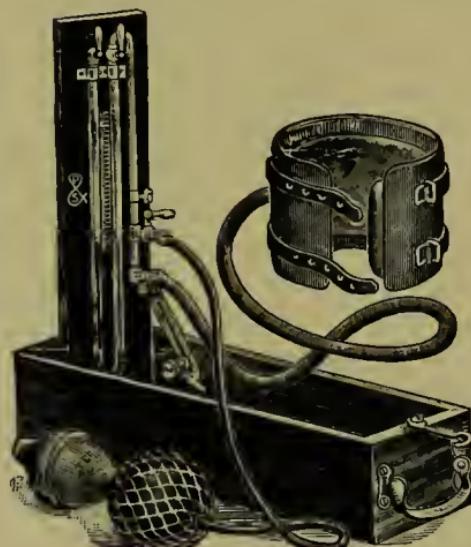


Fig. 5.—Faught's blood-pressure apparatus.

of the systole, but at the same time its height is restricted if the arteries are tense and rigid. A relaxed and dilated condition

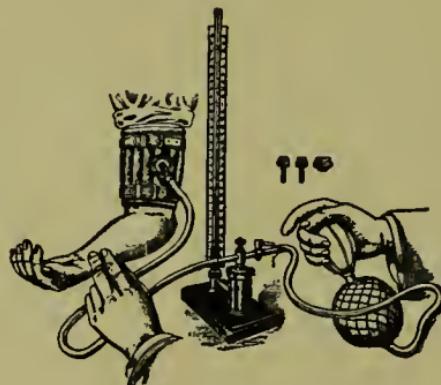


Fig. 6.—Stanton's sphygmomanometer.

of the blood-vessels favors an increase in the length of the up stroke; and conversely, arterial hypertension shows itself in a

lower stroke and a less marked dicrotic wave. A powerful heart may be matched against a weakened artery. Of course, no harm

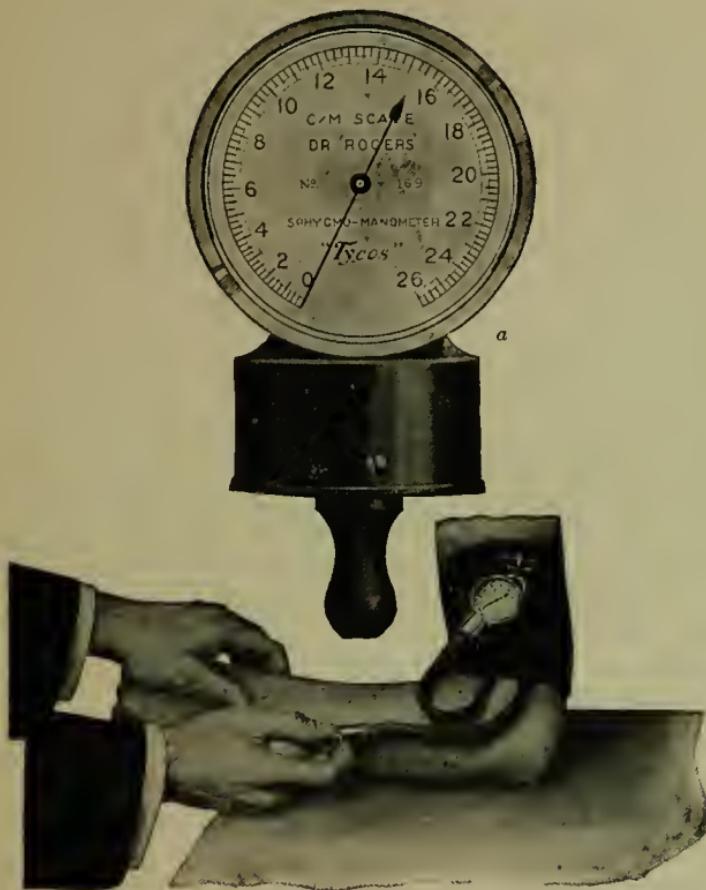


Fig. 7.—Dr. Rogers' "Tycos" sphygmomanometer: *a*, Gauge, actual size.

results when the vessels are resilient and free from atheroma; the accelerated circulation under favorable circumstances restores the nervous system and promotes health.

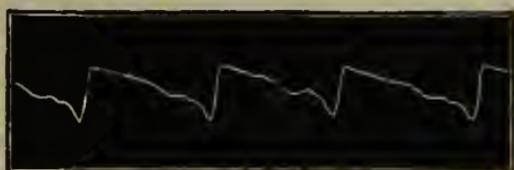


Fig. 8.—Tracing of a normal pulse (Sir Lauder Brunton).



Fig. 9.—Tracings of healthy pulse with varying degrees of tension: 1, Tension is high, owing to the contraction of the arterioles from cold; 2 and 3, diminished tension from warm clothing, showing relaxation of the arterioles (Sir Lauder Brunton, after Marey).



Fig. 10.—Tracing from the pulse of a patient aged sixty-two with gouty kidney, of a failing heart. This tracing and the three following show the effect of Nauheim baths in increasing the cardiac force and dilating the vessels (Sir Lauder Brunton).

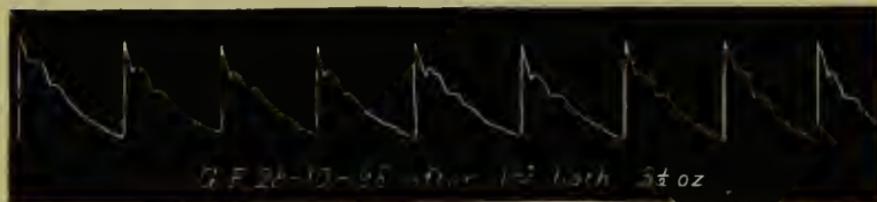


Fig. 11.—Effect of one bath (Sir Lauder Brunton).

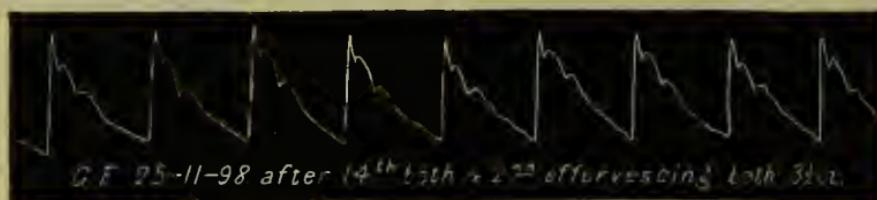


Fig. 12.—From the same patient (Sir Lauder Brunton).

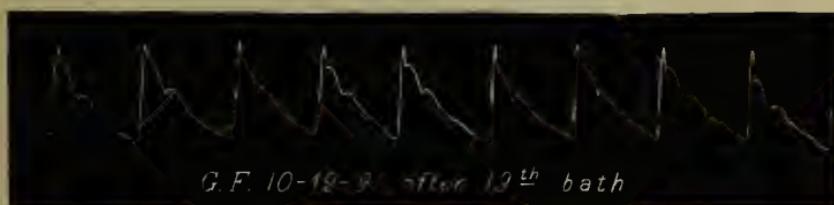


Fig. 13.—From the same patient after nineteen baths (Sir Lauder Brunton).

COUNTERINDICATIONS TO BATHS

A positive counterindication to such measures as the Nauheim bath, for instance, is any acute or subacute condition of the heart, and, on the other hand, the loss of compensation, as in chronic heart disease. In aneurysm great care should be exercised.¹ It is highly necessary to satisfy one's self that these conditions do not exist before prescribing the more stimulating measures. Palpation and percussion of the heart and the use of the sphygmomanometer are good routine methods before prescribing hydrotherapy; just as on a dangerous coast a navigator takes frequent soundings, the more often as the channel is obscured, avoiding the shoals and inevitable shipwreck. We know that the blood-vessels can bear a strain of 250 to 300 mm. of mercury as shown by the sphygmomanometer. H. W. Cook² has called attention to this subject:

"Overexertion, either physical or mental, anxiety, over-eating—especially of meats and certain toxins (auto, bacterial, metallic, or alkaloidal)—produce a rise in blood-pressure, and, therefore, added strain on the cardiovascular system, upon the integrity of which life and health so directly depend. This rise in blood-pressure, in part physiologic, becomes, when protracted over extended periods, a most pernicious and potent factor in inducing the train of cardiovascular diseases which develop in clinical manifestation, as cerebral apoplexy, aneurysm, arteriosclerosis, vertigo, angina pectoris, and nephritis. After the terminal affections have fully developed into clinical entities, it is too late to establish corrective treatment."

¹ The author has given these baths in a case of aneurysm of the arch of the aorta with benefit.

² Trans. Medical Society of Virginia, 1904.

EFFECTS OF THE HOT-AIR BATH

The effect of the hot-air bath, circular and cool fan douche, have been recorded by Dr. George T. Tuttle¹ in the case of 10 women, nurses and patients in the McLean Asylum. The instrument used was that of Riva-Rocci. The averages noted represent at least ten observations. He shows that there is a sudden fall of blood-pressure from 5 to 34 mm. of mercury, but this rises quickly to normal or above when the cool douche is applied.

EFFECT OF BATHS ON THE RATE OF THE HEART

The most striking results are noted under the influence of the hot-air bath followed by cool douches. In the hot-air cabinet

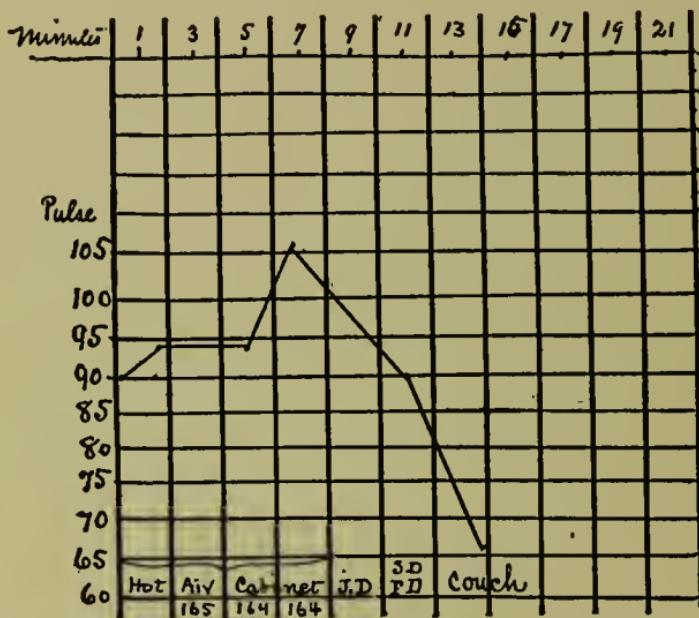


Fig. 14.—Effect of thermic stimulus on the pulse-rate. Showing a primary rise and a secondary fall of the pulse. Hot-air cabinet, 165° F. (73.8° C.), eight minutes; jet douche, two minutes, 105° F. (40.5° C.), reduced to 90° F. (32.2° C.); Scotch douche, 105° and 80° F. (40.5° and 26.6° C.), one minute; and douche, thirty seconds, at 78° F. (25.5° C.); rest on couch. Figures 14, 15, and 16 are from cases observed by the author at Hot Springs, Virginia.

¹ American Journal of Insanity, October, 1904.

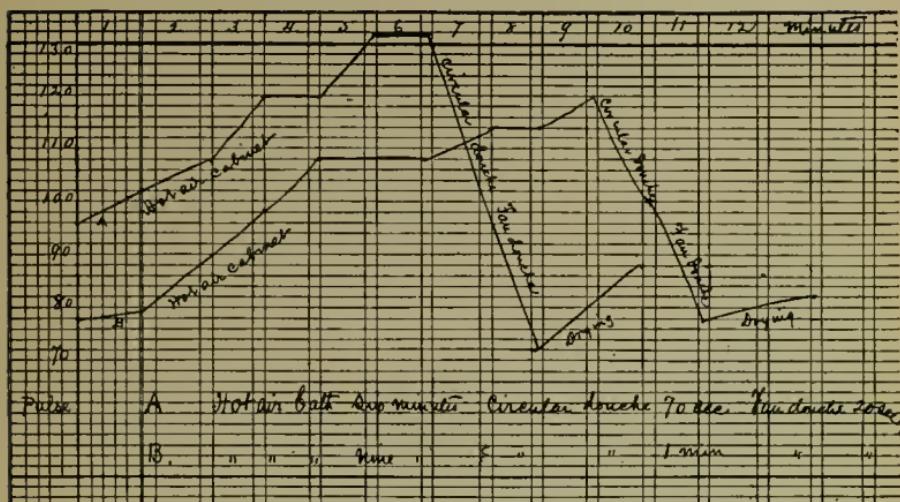


Fig. 15.—Showing the effect of thermic stimulus on the pulse.

Patient A.—Hot-air cabinet bath at 165° F. (73.8° C.), six minutes; circular douche, seventy seconds, 80° to 70° F. (26.6° – 21.1° C.), two minutes. Drying and rest on the couch. Primary rise of the pulse to 130; secondary fall to 70.

Patient B showed a lower primary rise and in two minutes a fall from 118 to 76.

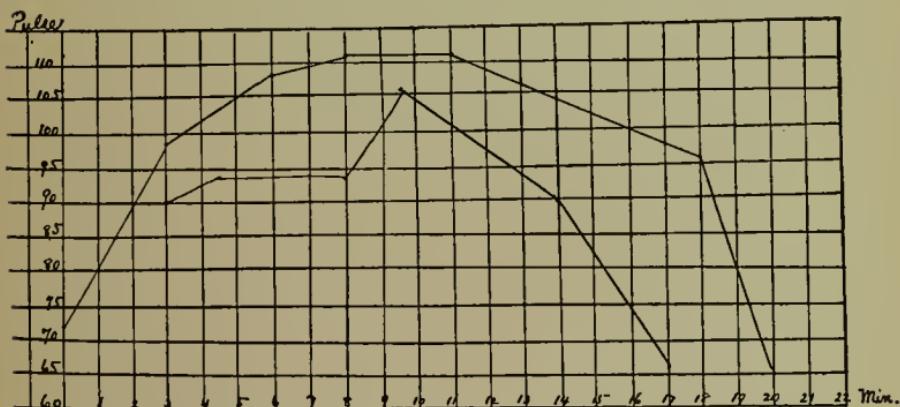


Fig. 16.—Chart showing the effect of thermic stimulation on the pulse. Observations made on Mr. P., aged forty-seven, on different days. Heart and circulation normal. The upper line represents a hot-air cabinet bath, temperature 173° F. for eleven minutes; circular douche $103^{\circ} > 85^{\circ}$, 20 pounds; two minutes; jet douche, $100^{\circ} > 70^{\circ}$ F., for one minute, 20 pounds; Scotch douche, 120° and 70° , twenty seconds, 20 pounds; Fan douche, 75° , ten seconds, 25 pounds. Initial pulse 72; maximum pulse, 112; minimum pulse (20 in minute), 66.

In the second bath the temperature of the hot-air cabinet was 165° F. Duration ten minutes. Circular douche, $106^{\circ} > 85^{\circ}$, two minutes, 21 pounds; jet douche, $105^{\circ} > 70^{\circ}$, one minute, 22 pounds; Scotch douche, 105° and 70° , fifteen seconds, 21 pounds; fan douche, 68° , ten seconds.

at a temperature of 170° F. (76.66° C.) the author has noted a rise in rate from about 70 to 120 per minute, and as the douche was cooled to 65° F. (18.33° C.) the pulse rapidly fell. A drop of 60 beats inside of five minutes or less has been noticed, and, as the patient was rubbed, the rate rose to a little above normal. Such changes in the rate and slight changes in the rhythm should be expected. They illustrate the quick response which the circulatory system makes to the stimulus of water applied in this manner. (See Figs. 14, 15, 16.)

THE EFFECT OF BATHS ON THE BLOOD

The effect of baths on the blood-count has been carefully studied by Dr. Fernald, who found that there is sometimes an increase and again a diminution in both the red and white cells, and sometimes an increase in one and a decrease in the other. If the cold bath be prolonged, the surface vessels allow an irregular distribution of cells and plasma, owing to the contraction of the surface capillaries by cold. Under strong contraction it is believed that the plasma may run on and leave the cells stranded. In all general measures producing a decided hyperemia of the skin, it must follow that a corresponding amount of blood is withdrawn from the internal organs; and, again, as the skin is rendered temporarily anemic, the blood returns to the deeper recesses of the body. In this manner both derive benefit, and the abdominal viscera particularly become less lethargic and by increased activity favor well-being.

Hydrotherapy thus starts a conflict between the center and the periphery for the possession of the blood, and its influence in promoting a rapid interchange is doubtless more significant than any particular change in the ratio of its various elements.

In all general procedures in which thermic and mechanical stimuli of not too intense a type are applied to the entire surface of the body, with very few exceptions, there is not merely a diminution of the leukocytes, but an increase of the red blood-cells when a test is made from the finger-tip or the ear.

The hemoglobin may also be increased by about 14 per cent. according to Winternitz. Moderate procedures are thus favorable for anemic patients (see p. 159). Warm packs and compresses tend to increase the leukocytes and diminish the red cells.

Paroxysmal hemoglobinuria has been known to occur after very cold baths. This has been ascribed to some hemolytic property imparted to the plasma.

EFFECT OF COLD AND HEAT UPON RESPIRATION

The cold douche produces at first short, gasping respiratory movements, a sudden cold stream under high pressure producing the most marked effect. A full cold bath produces, after the first few moments, slow, full, and deep respiratory movement. The cold douche or spray accelerates the respiratory rate.

Dry heat retards the respiratory gaseous interchange, increases the rate of respiration, but at the same time renders it less efficient and deep.

During a hot bath, although the rate is increased, the respirations gradually become deeper. The skin's action is increased, but there is a corresponding elimination through the lungs of much moisture and toxic material.

The sudden stimulus of hot water, as in the case of sudden stimulus by cold, tends to check the breathing in the act of inspiration. In very hot baths or those that are long continued, especially when the patient is not accustomed to them, there is liable to be dyspnea and weakness of the heart. In electric-light baths there is an increase in the respiration rate corresponding to the elevation of temperature. We see, then, that the rate is increased by both heat and cold.

SPECIAL HYDROTHERAPY

IN ancient times water was highly regarded as a restorative, and there are many classic allusions to the value of warm baths. These were especially advised for the aged and commonly adopted among the Greeks. Ulysses, on his return from Ithaca, found his father, Laertes, greatly debilitated, and immediately advised warm bathing.

Ulysses, in his famous visit to Circe, was treated to a most luxurious bath, which Homer describes in the *Odyssey*: "And four handmaidens, who are her servants in the house, were busy in the place. But they, indeed, were sprung from the fountains and from the groves, and from the sacred rivers which flow forth into the sea. One of them threw beautiful blankets upon the thrones, purple above; but under she put beautiful linen; another extended silver tables before the thrones, and set upon them golden dishes; a third mixed sweet honeyed wine in a silver bowl and distributed golden cups; but the fourth carried water and lighted a great fire under a large tripod and water was warmed. But when the water boiled in the shining brass, having put me in a bath, she washed me and anointed me with rich oil. She threw a beautiful cloak and garment about me and, leading me in, seated me on a silver-studded throne, beautiful, variegated; and a foot-stool was under my feet."

Sir J. Floyer, of Litchfield, published a book on hydrotherapy in London, in 1697, that went through six editions and was translated forty years later into German and published in Breslau and Leipsic. The sixth edition was entitled "*Ψυχρολογία*. The history of cold bathing, both ancient and modern; showing that the present hydrotherapeutic treatment was successfully followed in the seventeenth and eighteenth centuries, proving

its efficiency, and containing a variety of cases and cures in gout, rheumatism, consumption, asthma, insanity, fever, small-pox, hypochondriasis, etc., together with a few truisms for all doctors to think upon. Abridged from the fifth edition, published in the year 1772, Manchester, 1844."

Floyer, on the title page of the first edition, added: "Also proving that the best cures done by the cold baths are lately observed to arise from the temperate use of hot baths first."

TYPHOID FEVER

The systematic use of water in cases of ship fever or typhus apparently dates from the time of Dr. Robert Jackson,¹ who used warm baths followed by cold affusions about 1774. Dr. Wright, who practised in the West Indies, applied the same treatment to himself and a companion suffering on shipboard about 1777. In 1797 James Currie, an English ship surgeon, advocated strongly the use of cold baths in all cases of fever, and practised it successfully on shipboard. He used affusions of salt water. His writings influenced Nathan Smith, of New Haven, who practised it in 1798, very shortly after its introduction by Currie, whose book was translated into several languages. In 1802 Dimsdale published in London "An account of cases of typhus fever in which the affusion of cold water has been applied in the London House of Recovery." Since that time typhus and typhoid have been differentiated.

The next prominent character in hydrotherapy was Vincenz Priessnitz (1801–51), a farmer of Grafenberg, in Silesia, who practised a crude method of hydrotherapy with astonishing success. His method was to induce perspiration and then to apply cold water so as to induce a reaction. He also made use of the cold compress known as "Priessnitz' Umschlag"—a most valuable application.²

¹ Robert Jackson, *Exposition of Cold Affusion in Fevers, 1808.*

² See *Zur Wirkung des Priessnitzchen Umschlags bei der Entzündung*, by Dr. H. Schade, in *Kiel Münchener Medizinischen Wochenschrift*, No. 18, 1907.

Credit also is due to Dr. Hiram Corson, of Montgomery County, Pennsylvania, who for more than fifty years treated typhoid fever, as well as other infectious diseases with high temperature, by means of cold baths. This remarkable man, who was graduated from the University of Pennsylvania in 1828, practised cold-water bathing, notwithstanding the lack of any general sympathy with the method which has since become popular, and he obtained success even with all the disadvantages attending country practice.

THE BRAND TREATMENT

It, however, remained for Brand, of Stettin, under the title "Die Hydrotherapie des Typhus," published in 1861, to popularize this invaluable method of treatment. There are various modifications of Brand's method which will be referred to later.

It is a mistake in treating fevers by hydrotherapy to apply very low temperatures, very slight mechanical stimuli, and only for a short period. Such applications, according to Winternitz, raise the temperature instead of reducing it. Long cool, not cold, baths, rather intensive mechanical stimuli, tranquil rest under adequate covering after such a bath, and its repetition at the proper time are the necessary factors. By paying attention to the body temperature alone the physician is apt to err by too frequent and too cold baths in the severe infectious diseases.

In this manner nervous disturbances may be engendered, but by longer intervals, slightly warmer water, and longer baths these complications are avoided. In typhoid a very dicrotic and rapid *pulse* is more important as an indication for repeating the baths than a high temperature. Very rapid pulse with a still vigorous heart calls for wet packs, repeatedly changed, which in case of a slow pulse and signs of weakness on the part of the heart would be a serious blunder.

The behavior of the *blood-vessels* is the guide for the choice of the temperature and for the length and degree of the mechanical stimulation. When the vessels display a paralytic tendency, the most energetic thermic stimulation is demanded with avoid-

ance of much mechanical stimulation of the skin. This may be accomplished by brief dips and douches of quite cold water.¹

Alcohol.—Although Brand himself advocated it, there is some difference of opinion as to the value of alcohol given before and after the Brand bath in typhoid fever. J. C. Wilson, Tyson, Musser, Stengel, W. Gilman Thompson, and others generally employ it. The best time is twenty minutes before the bath, so as to allow for absorption. Winternitz gives a single mouthful of wine. It has been urged, however, that nervous sensibility is lessened by its use, and the effect of the bath on the nervous

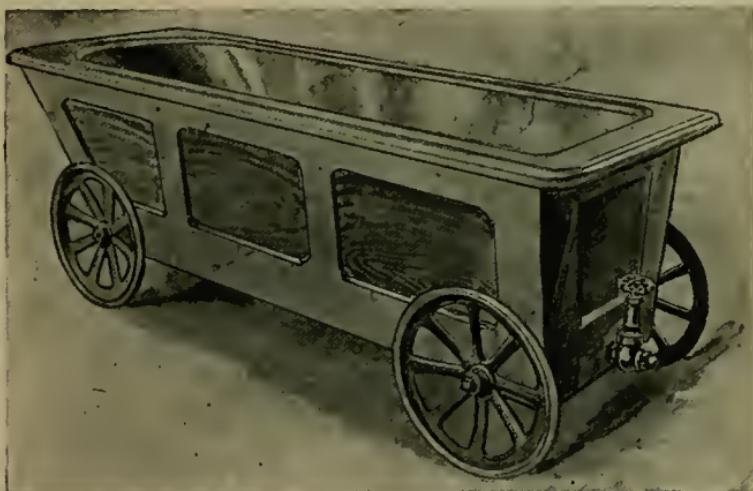


Fig. 17.—Wheeled tub (An American Text-book of Applied Therapeutics).

system is to that extent reduced. In other words, their effects are antagonistic. It is probable that the theoretic objections to the use of alcohol under these circumstances are not of practical importance, for clinical experience does not seem to justify the objection.

Dr. James Tyson's rules for use in the Hospital of the University of Pennsylvania in typhoid cases are as follows:

Absolute rest in bed. Milk diet as prescribed by the physician in charge. Patient must be encouraged to void urine before the bath.

¹ W. Winternitz, Missgriffe bei Wasserkuren, in Berliner klin. Woch., April 3, 1905.

Cover loosely with a sheet and gently lift the patient into the tub, which is placed alongside the bed. Temperature of the water usually 70° F. (21° C.). Always have an air-cushion upon which to rest the head; during the bath rub the patient briskly in order to keep up good circulation. A compress of iced water or an ice-cap is kept on the head. At the end of fifteen minutes lift the patient into bed. Dry and lay between blankets for fifteen minutes. As soon as the patient ceases to shiver—usually within fifteen or twenty minutes—take the temperature. The temperature is not taken again until three hours after the bath. If it is then 102.2° F. (39° C.) or above, the bath is repeated. If the temperature is 102° F. (38.9° C.) or below, but above 101° F. (38.3° C.), it is taken again in one hour; if below 101° F. (38.3° C.) and above 100° F. (37.8° C.), taken in two hours; and if below 100° F. (37.8° C.), it is taken in three hours. But whenever the temperature reaches 102.2° F. (39° C.) the bath is given, provided three hours have elapsed since the last bath. Eight baths may be given in twenty-four hours.

The normal effect of a cold bath is a reduction of 2° F. (1.1° C.). The nurse must watch the patient's face and take the pulse frequently while in the bath. In addition to the lowered temperature, the immediate effect of the bath is to add strength to the heart and to increase the volume and slow the rate of the pulse.

In *sponging*, a thin film of water should be kept on the surface sponged, for it is the evaporation of this which is effectual in cooling the body. If the patient be constipated, a simple enema should be given every other day.

Hemorrhage demands absolute quiet, cold by means of ice to the abdomen, a minimum amount of food, and elevation of the foot of the bed.

Dr. J. M. Anders, at the Medico-Chirurgical Hospital, Philadelphia, when using baths in typhoid fever, usually keeps the patient in the bath at first for only five or ten minutes; later, ten or fifteen minutes, according to the severity of the case. The head and face are bathed from a basin and a cold compress

is applied to the forehead at the start. If prominent nervous symptoms are present, often associated with high temperature, water at 70° F. (21.1° C.) or lower should be poured from an elevation of about 6 inches upon the head and nape of the neck several times during the bath. The ears must be stopped with cotton while douching is practised. In obstinate and severe cases in which the fall of temperature may be less than 1 degree, Dr. Anders sometimes prolongs the bath to twenty minutes, or still further reduces the temperature of the water. In light cases the cold bath should be repeated every six or eight hours; in severe ones, every three or four hours, but oftener than this is not advisable, even in the worst cases. The patient should be allowed to sleep at night if possible.¹

Dr. Alfred Stengel's rules for use in the Hospital of the University of Pennsylvania for typhoid cases are:

Temperature, pulse, and respiration every three hours. Sponge at temperature of 101.2° F. (38.5° C.). Bath at 102.4° F. (39.1° C.). Have the temperature of the water 70° F. (21.1° C.). Ice-caps to head continually. Simple enema every other day if necessary. The tub is used only in cases of typhoid which begin with some definiteness of symptoms. Those that begin in a very mild way are not usually tubbed, but only in case of some manifestation. If the patient is very nervous or the bath is not well borne, they are discontinued. No children are bathed according to the Brand method, and baths are not given during menstruation.

Dr. Musser's rules are:

Temperature, pulse, and respiration every two hours. Sponge at a temperature of 102° F. (38.9° C.). Tub at 103° F. (39.5° C.). Have temperature of the water 80° F. (26.7° C.). Reduce to 70° F. (21.1° C.).

Milk (3iv) with lime-water (3ss) every two hours. Ice-cap to head continually. Take temperature during the bath or immediately after, and again in fifteen minutes.

As a rule, the patient should be lifted into the tub, but very

¹ J. M. Anders, *Practice of Medicine*, ninth ed., 1909.

heavy patients, if their conditions warrant it, may step from the bed into the tub close at hand. Some permit the patient to walk a little way to the tub, but this is a needless risk.

The Tub.—A good portable tub has been made according to Dr. Baruch's design. It has the advantages of allowing the patient's legs to be flexed as he lies in the tub, the feet resting against a double bottom which is filled with warm water introduced through a tube with a funnel-shaped opening near the upper margin. The water is drained off through the lower faucet.

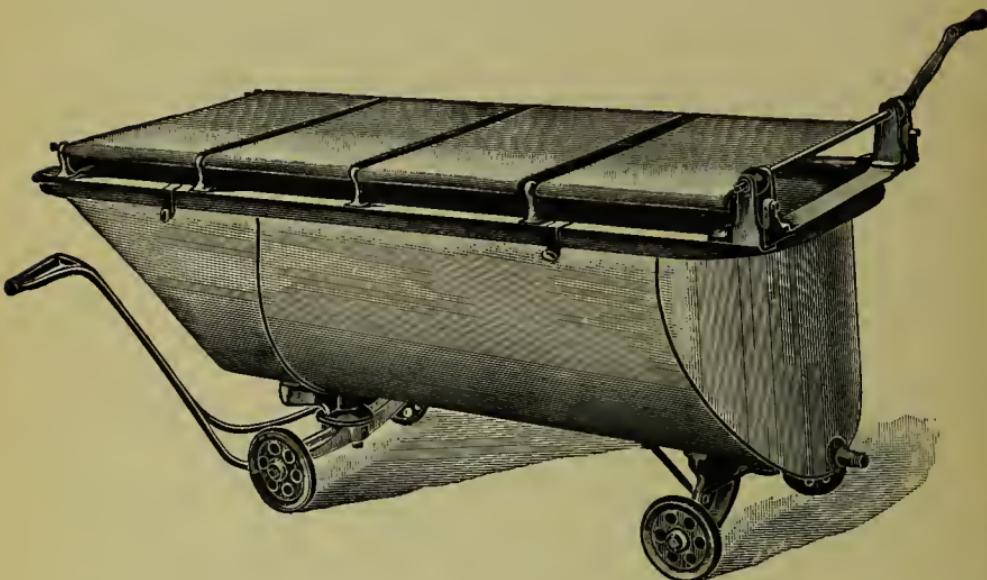


Fig. 18.—Hospital bath-tub with elevator stretcher.

The tub itself is filled with colder water. This style of tub is comfortable to the patient and, being higher, enables the nurses to handle him more easily and work to better advantage. It is also shorter and lighter than the ordinary tub. (See also p. 66.)

There are cases of typhoid fever with evidence of profound toxemia, but in which the temperature is below 102.5° F. (39.2° C.). Tepid and warm or even hot (104° F.—40° C.) full baths are then indicated and friction should be applied. In this way there is a better chance to restore circulatory equilibrium, reduce the toxemia, and favor a restoration to the normal

temperature of the body. H. A. Hare has always favored substitutes for the Brand method since his personal experience with typhoid fever in 1900, and there is an evident trend of opinion away from tubbing and in favor of sponging and other substitutes, unless the temperature rises above 102.5° or 103° F. (39.2° or 39.5° C.).

Important Guides Besides the Thermometer.—While it seems necessary to formulate certain rules as to tubbing, especially in hospital practice, it must not be forgotten that there are important guides besides the thermometer; for, as Gilman Thompson says, this instrument only records the average or temporary balance of heat gain and loss. Excessive heat production, if accompanied by proportionally rapid heat loss, may give a low thermometric record, and yet the obscure abnormal metabolism producing the increase in heat may be working great havoc within the body. This fact may in some degree account for the exceptionally rapid emaciation in a certain class of cases in which the thermometric record remains low throughout; for heat production in the body is mainly due to chemic processes, its loss, to physical processes.¹

During the Franco-Prussian War a large number of fatalities from typhoid fever were reported in a series of cases in which the temperature did not reach 102° F. (38.8° C.).

Rubbing.—The intense involvement of the nervous system in severe cases is shown by the early headache and disturbance of special senses; by restlessness and insomnia and the delirium; subsultus, tremon, and the whole train of familiar symptoms. It is here that sudden cold and vigorous rubbing are demanded. Indeed, rubbing may be the keynote to the whole system of tubbing. For the full use of rubbing Thompson prefers a full bathtub, so that the patient may float and all surfaces of the body be easily accessible.

The Cold Bath.—Liebermeister, of Basel, over forty years ago adyocated the *lukewarm bath* at 90° F. (32.2° C.), gradually cooled, but this missed the valuable stimulating effect on the

¹ W. Gilman Thompson, Trans. New York State Med. Assoc., 1902.

nervous system and the vigorous reaction which is the real aim of the Brand bath properly administered. "It is the energetic friction which prevents shivering, keeps the skin in good condition, determines more blood to the peripheral vessels, and helps to divert the patient's mind from discomfort. A feature of no

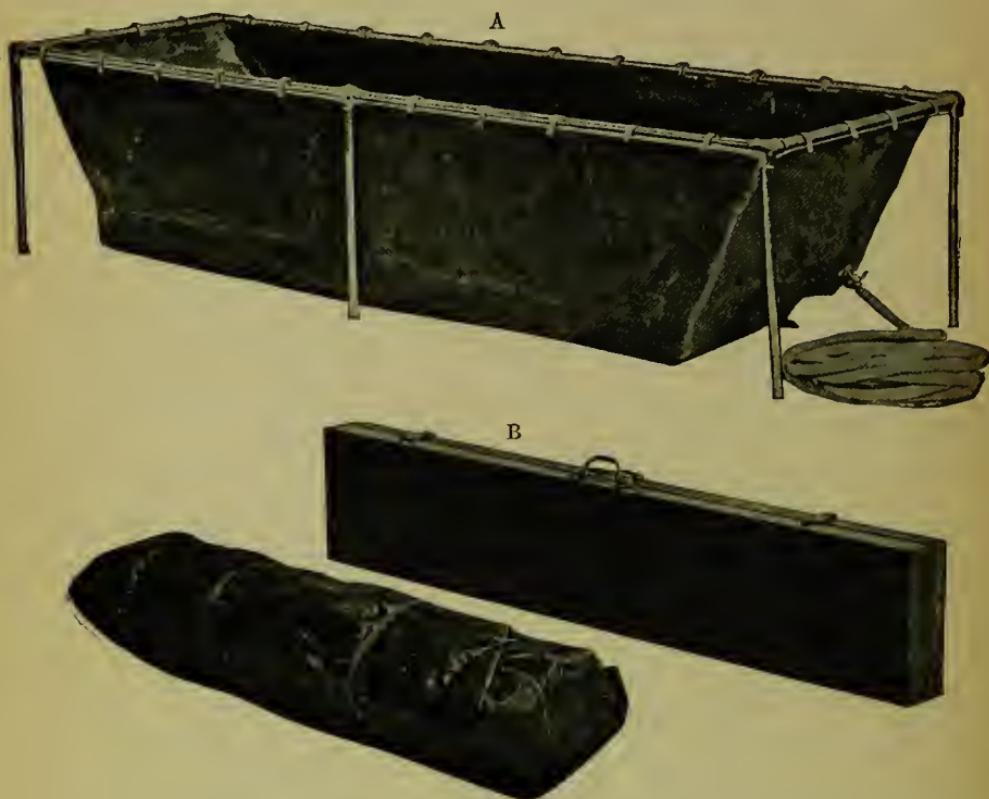
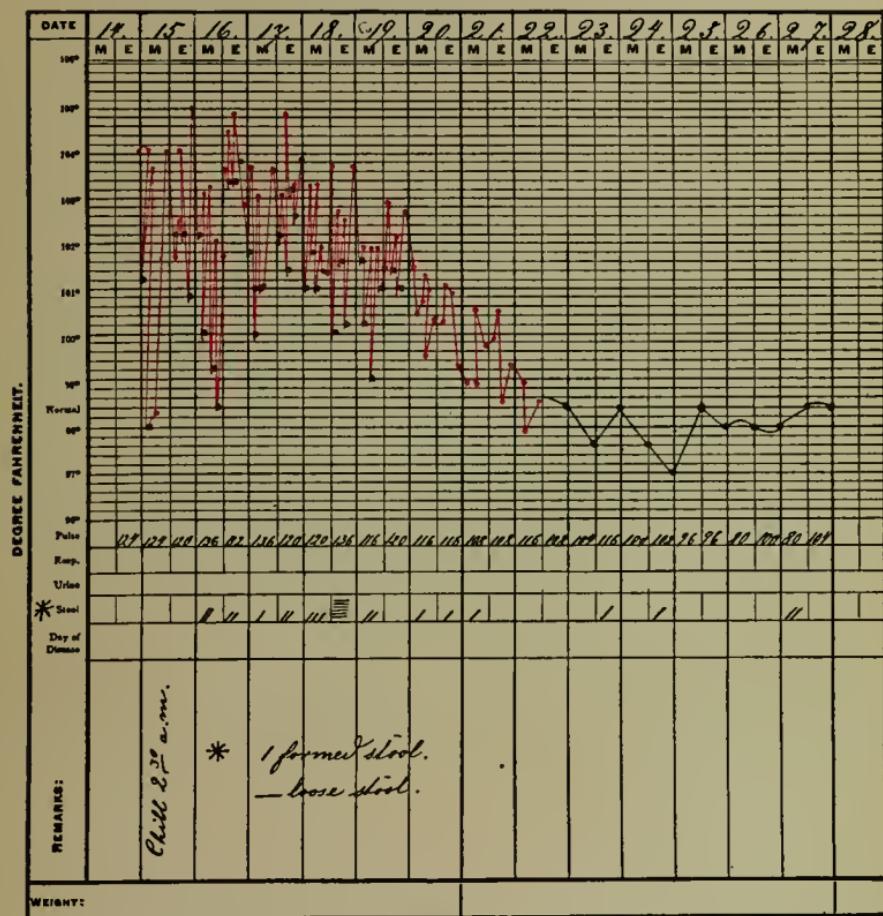


Fig. 19.—Portable bath-tub: A, Open, ready for use; B, folded, for transportation (An American Text-book of Applied Therapeutics).¹

little importance is the increased depth of respiration obtained throughout the cold plunge bath, which antagonizes the tend-

¹ A good folding bath-tub is made by Russell M. Irwin, 103 Chambers Street, New York, at a moderate price. A good portable and folding bath-tub has been invented by Dr. C. L. Furbush.

ency to pulmonary congestion and bronchial catarrh. As a more remote, but no less important, effect the digestion improves and nutrition is maintained, so that extreme emaciation is rare; bed-sores and general furunculosis are practically unknown, the



lation of the nervous system, even without immediate lowering of the thermometric record.

"In every considerable group of typhoid fever cases are a few in which the cold tub-bath fails to reduce the body temperature, and I have seen it even rise a little after a bath, while the patient showed marked improvement in other respects. I have records of cases in which sponge baths produced as decided an effect upon the temperature alone as did subsequent "tubbing," but I have yet to see one in which their effect exceeded that of tubbing, and in the great majority of cases they fall far short of it in every way."

Dr. Thompson's practice is to employ the tub-bath at 75° F. (23.9° C.) for fifteen minutes whenever the patient's temperature reaches or exceeds 102.5° F. (39.2° C.), and to insist on gentle but continuous friction of the skin by two nurses during the entire bath.

"Experience has taught the advantage of attention to detail in the treatment and the fallacy of rigid rules. Not a few patients do better with a bath of eight or ten minutes' duration than in one of fifteen minutes, or they may do better with water at 80° F. (26.7° C.) than at 75° F. (23.9° C.). Alcoholic stimulation should be given fully twenty minutes before the bath, to admit of its absorption before the cold is applied—a matter of no little importance. Shivering is less if the back be rubbed first, and the tub should be large enough and full enough to admit of readily floating the patient; on no account should he be left to shiver for several minutes in the tub while the nurse is preparing the bed for his return; he should be promptly and thoroughly dried when taken out of the tub and immediately left alone to sleep. These may appear trivial details, but anyone who has had personal experience in the tub realizes that they are not so, and they are often overlooked by those who state that they have applied this method of treatment, but gave it up on account of the patient's discomfort. I have met with far more complaint of the discomfort of cold sponge baths than tubbing among patients who have submitted to both.

"No one claims that cold tubbing 'cures' typhoid fever or even aborts it, but it unquestionably fortifies the nervous system against the factors of the disease, and enables the patient to endure what is at best a long and tedious siege with very much less misery. The only indications for its suspension are the occurrence of hemorrhage or pneumonia, when cold sponging should be substituted. The method most emphatically does not induce hemorrhage, or produce relapse, or cause neuritis, or any other serious complication, as has been claimed against it. Its justification is shown in the remarkable unanimity of the hospital records throughout the country, which show a mortality among thousands of cases averaging from 7 to 7.5 per cent. in each institution where the treatment has been faithfully carried out for years, as against a previous death-rate of double, often triple, that figure.

"Enthusiasm for hydrotherapy should not lead one to deprive the patient of sufficient rest, and except in cases of a temperature protracted in the neighborhood of 105° F. (40.6° C.), it is best to omit at least one of the three hourly baths at night, and if desirable to give a mild hypnotic."

The number of baths given in a single case may reach the extraordinary number of 175. This record was made by Kinnicutt in a case of such exceptional gravity and hopelessness that the question of discontinuing the baths was discussed; but it was decided to continue them. The patient made a good recovery.¹

It cannot be too often reiterated that the main object of the cold bath in typhoid fever or in any other febrile disease is *not* the reduction of temperature. The antipyretic quality of the cold bath, cold affusion, or cold spray is entirely subordinate to the general effect on the nervous system, the heart, the lungs, the blood, and its circulation. The cold bath cannot be considered alone without the all-important friction, the *sine qua non* of the cold bath. Even in such a serious affection as sunstroke, in

¹ See the Treatment of Typhoid Fever by Cold Baths, by George Wilkins, M. D., Trans. Association of American Physicians, 1892.

which it is highly essential that body temperature be reduced, the good effect of the use of cold water in the form of sprinkling and cold affusions is accomplished only by the vigorous stimulation of the nerve centers, inducing an added power to withstand the toxemia.

Brand summed up the benefits observed by him in typhoid by stating that the good effects of the bath are seen not only in the reduction of excessive temperature, but also in a clearing of the intellect, a lessening of the stupor, a disappearance of the muscular twitching, a general tonic influence upon the nerves, and especially upon the heart and lungs, in an improvement of all of the bodily functions, in the promotion of sleep, and, finally, in a reduction of the mortality. As a rule, no medication is required, and the use of alcohol is not necessary, except, perhaps, in those who have been accustomed to it. If constipation be present at the beginning, an initial full dose of calomel (gr. v) may be administered. In the course of the attack simple enemata may be employed.

The hydriatic treatment of typhoid fever may be employed at any stage of the disease and at any period of life. The best results are naturally secured the earlier in the attack the patient is placed under treatment. In cases coming under observation and submitted to the treatment prior to the fifth day, death may be entirely averted. Not all children bear the full cool bath well. In patients past sixty, it is best to use the gradually cooled bath, the water being at first about 10° F. (5.4° C.) lower than the temperature of the body, and being gradually reduced in the course of from twenty to thirty minutes to 68° F. (20° C.). The only complications that interdict the continuance of the baths are intestinal perforation, peritonitis, and free hemorrhage. Experience shows, however, that complications are, in general, less common in those treated according to the Brand plan than in those treated by any other method.¹

Counterindications.—On the whole, it may be said that the

¹ See also Some Considerations of the Treatment of Typhoid Fever, by A. A. Eshner, M. D., Medical News, Sept. 19, 1896.

Brand bath is not well borne by the very young or very old, and in patients who come under treatment as late as the third week. It is then rather difficult to get a good reaction. When the patient fails to react, it is a good plan to use tepid or hot water to redevelop the reactive power. The presence of complicating pneumonia is generally held to counterindicate the Brand bath.

It should be added in connection with bathing in typhoid fever that *renal complications* should not be deemed a counter-indication. Physicians differ in their practice as to baths during menstruation.

SUBSTITUTES FOR THE BRAND METHOD

A common practice in typhoid fever is to apply an *ice-cap* to the head when the patient's temperature reaches 101° F. (38.3° C.); cool sponging at 102° F. (38.9° C.), and a tub-bath at 70° F. (21.1° C.) when the temperature is 103° F. (39.5° C.) or over.

The Warm Full Bath.—This has been ardently advocated by Dr. Riess, of Berlin, who reports 809 cases of typhoid fever treated with baths of 88° F. (31.1° C.) for several hours at a time. When the temperature of the patient reaches 102° F. (38.9° C.) he is allowed to remain in the bath until the rectal temperature reaches 100° F. (37.8° C.). This may require from five to ten hours, and the procedure is repeated as often as the fever requires. Its success in Dr. Riess' hands was shown by a reduction in mortality from the previous record of 10 per cent. to 8½ per cent. Although the reduction was not over 15 per cent. of the previous mortality, the shortening in the duration of the disease was very noticeable and its best feature. It does not reduce temperature rapidly, its efficacy is not so great as by the Brand method, but it is a fair substitute.

Ice Rubbing.—One of the best, simplest, and most rational substitutes for the Brand bath in typhoid is ice rubbing. The ice to be used should have a flat surface and be held in gauze. The rubbing should be begun with the limbs and finished with the trunk, exposing only the portion being rubbed. Active

friction is required to bring the blood to the surface, and a successful and effective ice rub requires a good nurse, quite as good as in giving a Brand bath.

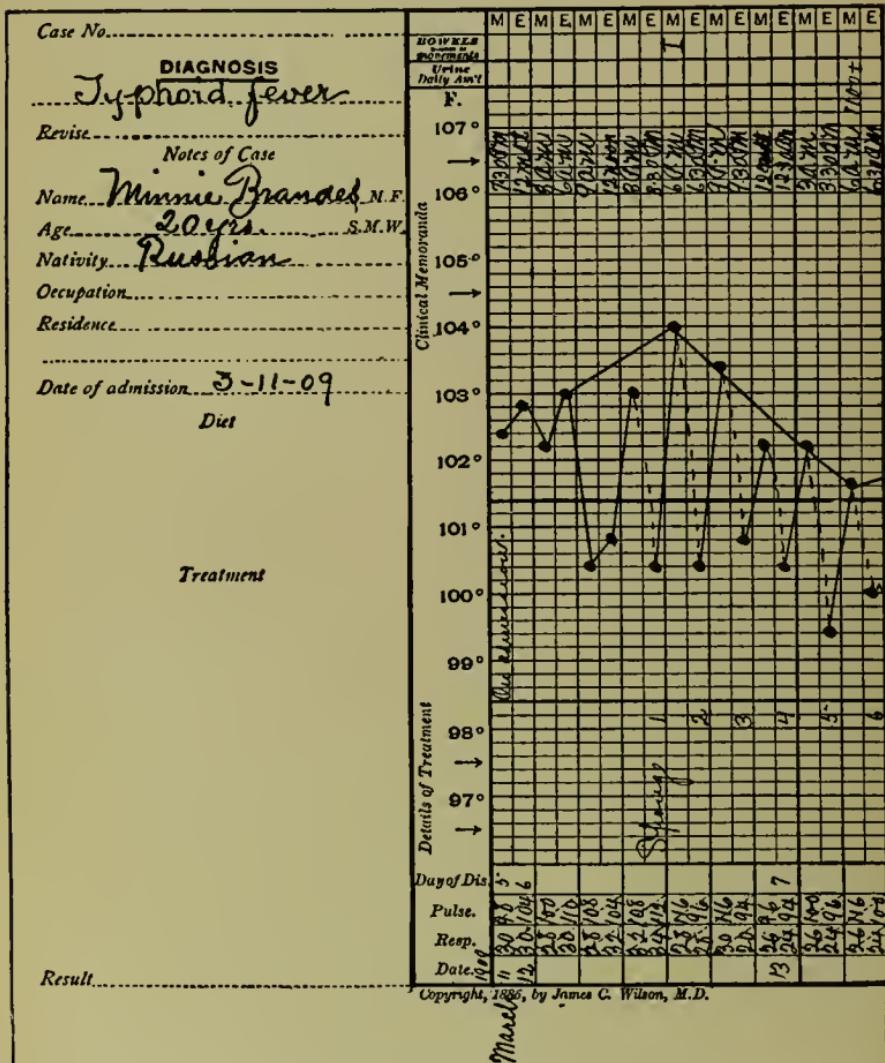


Fig. 21.—Ice rubbing in typhoid fever.

Dr. Hobart A. Hare, who has used this method exclusively for ten years, has kindly furnished the author with a chart showing the effect of ice rubbing in a case of typhoid fever. Eighty-one ice rubs were used in the course of four weeks. The

chart shows a fall of temperature of from 2° to 4° F. (1.1° – 2.2° C.) after the ice rubs; and usually, also, a slight reduction in the pulse-rate and a general subsidence of the disease.

The results of ice rubbing are identical with those of the Brand bath because the same principles are applied. There is the same impression upon the nervous system and circulation.

Ice rubbing is used sometimes in connection with sprinkling.



Fig. 22.—Ice rubbing and sprinkling. Cot should be elevated at the head (Cohen).

When *hemorrhage* is a complication of typhoid fever, an ice-bag or an ice-poultice should be applied to the abdomen. (See pp. 349 and 355.)

Sponging with cool water is widely preferred instead of the Brand bath, and commonly adopted when the temperature reaches 101° or 102° F. (38.3° or 38.9° C.). As mentioned previously, sponging is relied upon at these more moderate temperatures and the Brand treatment is reserved until the fever rises to 102.4° or 103° F. (38° or 39.5° C.). In Eng-

lish hospitals sponging is generally relied upon exclusively. The author recently visited Guy's, St. Thomas', and St. George's hospitals, and found that sponging was the only hydriatic method employed. Typhoid fever is, however, fortunately, more rare in England than in the United States. (For the Technic of Sponging, see p. 248.)

Investigation shows a marked change in the practice of bathing in typhoid among Continental physicians. This was summarized recently in "Excerpta Medica" (Leipsig, edited by E. Graetzer), in a symposium on the Treatment of Typhoid Fever, to which Eichhorst, von Strümpell, F. Schultze, Romberg, Erb, and others contributed.¹ They all agree as to the usefulness of Brand's method with certain modifications, especially when there is marked disturbance of the sensorium or of the respiratory or circulatory systems.

The following general statements may be made:

1. None bathe at night, between the hours of 8 P. M. and 6 A. M.
2. With but one exception, no one tubs unless the temperature is over 103° F. (39.4° C.).
3. Nearly every one uses the graduated bath, beginning about 90° to 95° F. (32.2°-35° C.), and very gradually cooling to rarely lower than 80° F. (26.6° C.).
4. But one or two ever exceed three baths daily, and nearly all speak of one or two baths as all that are necessary in the great majority of cases.
5. Short baths, without apparently any special regard to the reduction of temperature, appear to be most in favor. Many speak of ten to fifteen minutes' duration, some of five to ten minutes, and a few say simply "short."

In view of the interest and importance of the subject, a few quotations may perhaps be made:

Weintraub says "that unless the patient feels and appreciates the benefit of the cold bath, it is a 'torture' which is actually injurious." Korach says, "Forced bathing is horrible,

¹ Editorial, Colorado Medicine, May, 1909.

and injurious in severe cases." Grunert, a pupil of Liebermeister, says that "Systematic cold bathing is horrible." "Luke-warm baths of 90° to 94° F. (32.2°–34.4° C.) are desirable and sufficient for most cases," is the conclusion of Eichhorst. Lenhartz recommends "92° F. (33.3° C.) of five to ten minutes' duration, for the most part, twice daily." According to Schulze, "Their unremitting application is barbarous." Prof. Umber says, "We bathe most cases only once a day." Erb, one of the few who are still ardent apostles of the Brand method, says, "It is not an antifebrile measure"; he bathes, therefore, in all cases, but in the lightest only once daily, and in the moderate, twice, for ten to fifteen minutes in a bath gradually reduced from 95° to 75° F. (35°–23.8° C.). According to von Strümpell, "One or two baths daily mostly suffice; it is most earnestly warned against excesses." And, finally, Romberg writes as follows: "In the use of tubbing we cannot be guided by the temperature," having before emphasized the supreme importance of the condition of the sensorium and of the respiratory organs as an indication. "For the most part, one or two a day are enough," and "we prefer not to go below a temperature of 85° F. (29.4° C.).

Sprinkling is a good substitute for the Brand bath and is often better borne; it certainly is more easily carried out and has many advocates.

The head of the bed is first raised 10 or 12 inches from the floor. Three boards as long as the bed is wide are placed cross-wise under the mattress to keep it from sagging. A rubber sheet covered with a linen one is placed under the patient, whose head, wrapped in a cool wet turban, rests on a pillow. The night-dress is removed, and the water, at a temperature 10 or 12 degrees cooler than would ordinarily be used in the bath, is applied from a sprinkling pot or from an irrigating apparatus provided with a large rose nozzle. Active friction is kept up as in the Brand bath. Some practitioners use a dry linen sheet over the patient and sprinkle this with ice-water, using friction. The water should come from a height of 2 or 3 feet and should be directed chiefly to the abdomen and lower extremities. The

surplus water should be allowed to drain into a pail or tub. The patient is then wrapped in a dry sheet, covered with a blanket, and rubbed. The process is repeated as in the directions for the Brand bath. (See p. 60.)

The **wet cold pack** is another substitute, but its application is more exhausting to the patient than sprinkling, for it has to be renewed more frequently. Dr. Anders finds this method of great use in children. (For Technic, see p. 340.)

The **sheet bath** (Lakenbad, of Strasser) is preferable as a substitute for the Brand bath. The linen sheet is soaked in water at from 50° to 80° F. (10°–26.7° C.), as may be desired. The head and face of the patient are bathed in iced water and a cool wet turban is wrapped around the head. The bed is protected by a rubber sheet on which is placed the wet sheet partly wrung out. The patient is now placed upon the wet sheet, and, while his hands are held above his head, one side of the sheet is laid over the chest close under the axilla and beyond the axillary line of the opposite side, and folded in between his legs. The arms are now brought down and the opposite side of the sheet is then passed across the body and snugly fitted in place, covering the arms and shoulders and tucked under; the lower end is tucked under the heels.

The nurse should rub the body thus enveloped and should pour cups of water at 50° or 60° F. (10° or 15.6° C.) as the sheet warms, and commence rubbing again. This is continued until the patient feels cold or shivers quite perceptibly. More friction, however, will obviate this. He may lie in pack, if comfortable, for half an hour, the rubber sheet being withdrawn and a blanket substituted.

The wet cold pack should be employed where tubs are not to be had or when tub-baths are opposed. (See p. 340.)

Ice-water enemata may be tried in desperate cases.

Hot Sponging.—This substitute for bathing sometimes yields excellent results when the patient is very nervous, or when, for any other reason, Brand baths cannot be given. The water should be at about 110° or 112° F. (43.3° or 44.4° C.); in

another receptacle containing water at about 100° F. (37.8° C.) place a 2-ounce bottle of grain alcohol.

Sponge the limbs separately and then the body for ten minutes, and finish with a quick general rubbing with the warm alcohol. This is an excellent method, especially for children. The temperature of the water and alcohol may be lowered and its strength varied as judgment and experience with the patient may indicate. The alcohol sponge may be tempered to suit the feelings of the patient and the strength may vary from 25 to 95 per cent.

Oil Inunctions.—Among other substitutes for bathing, used with great success when cold applications cannot be given, are inunctions of oil. Although they are not hydrotherapeutic measures, they are mentioned here because cases have arisen and will be met with in which the external use of cold must be discontinued owing to the extreme depression and shock it produces.

After inunctions of oil the patient is more comfortable, the temperature is slightly reduced, and sleep is favored. There seems to be less waste and prostration.¹

Conclusions.—As far as substitutes for the Brand bath are concerned, we need more extensive statistics of the results of treatment by sponges, ice rubbing, etc. Elaborate reports are accessible in reference to baths, and we acknowledge the good results obtained. Dr. McCrae² says of the substitutes for Brand baths: "They have no marked influence on the general condition, and while they give comfort and are undoubtedly helpful, their effect is in no way to be compared to that which follows hydropathy in the form of baths."

Much of the benefit of hydrotherapy is attributed to the greatly increased excretion of toxins. One of the errors which most of us are still laboring under is our attitude with reference to the presence of fever and a failure to recognize its remedial

¹ See John H. Musser, A Protracted Case of Typhoid Fever: Some Features of Treatment, Trans. Phila. County Med. Soc., 1895.

² Osler and McCrae's System, vol. i, p. 213.

character. Patients are not to be treated in a routine manner, and fever patients, above all, are not to be given antipyretics, either internally or externally, simply because the body temperature rises above a certain mark.

Attention has been called of late by our best clinicians to the fact that either a local or general fever develops in practically all infectious processes, failing to develop only in those cases in which the infection is so overwhelming that the organism does not have an opportunity to protect itself. If an animal be given a moderate infection it speedily recovers if fever is permitted to occur, whereas, if fever is prevented, it dies.¹ Dr. Hare has pointed out that if fever is prevented by the use of antipyretic measures, infections otherwise innocent prove fatal, and from this we learn the important fact that in the vast majority of instances the physician should not attempt to modify fever, but rather to regard it as a helpful ally, and as a manifestation which will help him materially in gauging the severity of the illness and the ability of his patient to combat it, although when the fever becomes a hyperpyrexia, exceeding 103° or 104° F. (39.5° or 40° C.), for a considerable period of time, it may become a symptom which requires attention. This view, at first sight, may seem to be in opposition to the well-recognized value of the employment of the cold bath in typhoid fever, but in reality no such antagonism exists, because it has been proved that the use of the cold bath in typhoid fever actually increases the production of heat in the body, and probably at times actually raises the temperature of the internal organs, at least for a few moments. In other words, the use of the cold bath in typhoid fever, to use a simile, opens the draughts and increases oxidation processes—that is, it increases the production of heat, although at the same time a large amount of heat is abstracted from the body by its exposure to cold. To express it differently, the metabolic changes which are produced by the increased oxidation processes associated with the cold bath aid the system materially in combating the infection, not only the heightened

¹ H. A. Hare, Therapeutic Gazette, March 15, 1910.

temperature, but the metabolic changes, as just pointed out, being protective in their nature. MacCallum¹ goes so far as to express his conviction not only that the febrile process is an action beneficial to the organism, but believes that it is intimately associated with the development of protective substances to combat the injurious agencies which have invaded the body.

MEASLES

In measles the common practice is to use lukewarm baths, 96° to 98° F. (35.6°–36.7° C.), to bring out the eruption and, possibly, cool sponging if the fever be high. European authorities, especially Winternitz, hold that the indications are for powerful mechanical with only slight thermic stimulation. Rubbing down with a fine linen cloth wrung out of quite cold water responds to the indications in measles. The delayed eruption frequently appears at once after this procedure, and threatening symptoms vanish.

If the child be irritable, the nurse may sponge with a mixture of one-fourth alcohol and three-fourths water at 80° F. (26.7° C.) under the bed-clothes, and thus prepare the way for full baths. There is no objection to giving cool water to drink during the febrile stage.

Hot full baths at 103° F. (39.5° C.) have been warmly advocated by Dr. Friedrich Grosse, of New York, for very young children.² The duration is only three minutes for a child one year old, but may be lengthened to four or six minutes later on. Some hotter water is added during the bath, so as to bring the temperature up to 106° or 107° F. (41.1° or 41.6° C.), and this proves a wonderful stimulant in cases of impending collapse. The baths are repeated several times a day. Children do not react to cold water, and in poorly developed and poorly nourished children the higher temperatures of the bath are much better borne. They require baths considerably higher than adults.

The late Dr. Hiram Corson, of Pennsylvania, treated thousands

¹ W. G. MacCallum in his Harvey Lecture, 1909.

² Archives of Pediatrics, May, 1908.

of children with measles, and claimed that he never lost a case. He gave a laxative and sponged the whole body with cold water.¹

In severe cases baths may be given every two hours night and day at 60° to 68° F. (15.6°–20° C.). In general, the hydrotherapy of measles is similar to that of scarlet fever. Currie's method of cold bathing in these diseases applies to the more severe types.²

SCARLET FEVER

Ordinarily in scarlet fever the patient should be sponged over the entire body twice a day, using three-fourths water and one-fourth alcohol, cold, cool, or lukewarm, depending upon the fever. Petrolatum or cold cream should then be used.

In mild cases a lukewarm or hot bath is commonly used to favor the action of the skin; but in severe cases, where the vessels display a paralytic tendency, the most energetic thermal stimulation is demanded, with avoidance of much mechanical stimulation of the skin. Brief dips and douches of quite cold water are often surprisingly effectual.

The most prominent signs of *collapse* and *heart weakness*, in this as in other affections, are the high temperature in the mouth and rectum, with clammy extremities. This condition calls at once for the application of heat to the periphery and the abstraction of heat from the trunk. Cold packs to the trunk and heat to the extremities will save many a desperate case.

Even in desperate cases it will be a mistake to apply water too suddenly to the patient, and thus frighten him and arouse antagonism. The requisite degree of cold may be obtained by gradual stages, thus avoiding nervous excitement of the child and retaining the confidence of the parents. There is a prevalent and time-honored belief that cold water should not be used in scarlet fever and measles lest the rash be repressed or "go in," and it takes courage, tact, and good judgment on the part of the attending physician to adopt and carry out successfully measures

¹ See University Medical Magazine, Philadelphia, 1891.

² James Currie, Medical Reports on the Effects of Water, Cold and Warm, as a Remedy in Fever and Other Diseases, London, 1797.

so much opposed to widespread belief. However, the public is gaining confidence in the use of cold water, especially since the Brand method of cold-water bathing has been so widely practised with such evident success. The more prevalent use of cold compresses and ice in pneumonia has also aided in this change of sentiment. The best of modern specialists in children's diseases hold that there is no disease of childhood with high temperature in which the application of water to the skin does harm.

The indications for the use of cold are high temperature, restlessness, loss of sleep, rapidity of the heart, and an evident lowering of the vitality. The degree of temperature cannot be stated arbitrarily; at least, the thermometer must not be too implicitly relied upon. In some cases unfavorable symptoms may coexist with a temperature of only 103° F. (39.5° C.); in others at 104° or 105° F. (40 or 40.5° C.). The physician must be the judge, and it is probably better to begin the use of cold at the lower temperature of 103° F. (39.5° C.) than to wait for the development of the higher record. Cases must be decided on their individual needs.

The Cool Pack in Scarlet Fever.—This is a safe and effective method of meeting pyrexia and its associate bad symptoms. The use of this cooling wet pack in the graduated method advocated by Kerley¹ is practical because it avoids unnecessary shocks, is easily applied, and accomplishes good results. It is given as follows:

Preparation of the Cool Pack.—First the bed is protected with a rubber sheet. A large bath-towel or some thick, soft absorbent material should be used for the pack; muslin, linen, or any thin material does not answer so well. Slits are cut in the towel large enough for the arms to pass through, and the towel is folded around the body, enveloping only the trunk and buttocks. The pack should not extend below the middle of the thighs. This leaves the arms and the greater part of the lower extremities free. A hot-water bag, carefully guarded, should be placed at the feet and the patient covered with a blanket

¹ C. G. Kerley, Jour. Amer. Med. Assoc., Oct. 24, 1908.

of medium weight. The towel is moistened with water at 95° F. (35° C.). This higher temperature is necessary at first in order not to frighten the patient, as sudden cold is likely to do, and also to avoid shock. In two or three minutes the towel, without being removed, is again moistened with water at 90° F. (32.2° C.), later with water at 85° F. (29.5° C.), and still later at 80° F. (26.7° C.). When the temperature of the water reaches 80° F. (26.7° C.) it is better to hold it at this point for half an hour; then the patient's temperature should again be taken. If at the beginning his temperature was 105° F. (40.5° C.) and now shows but slight or no reduction, the temperature of the water with which the towel is moistened should be reduced to 70° F. (21.1° C.) or, if necessary, even to 60° F. (15.6° C.). The child throughout need not be disturbed, except to turn him from side to side to wet the towel with water of the desired temperature, this being one of the advantages of the pack over a tub-bath or sponging.

Duration of Pack.—For the first hour or two in a pack the temperature of the patient should be taken every half-hour. When it is reduced to 102° F. (38.9° C.), the pack should be removed, for, if it be continued longer, too great a reduction may take place. If it rise again rapidly to 105° F. (40.5° C.) or higher, it is well to keep the patient in the pack continuously. The degree of cold necessary, in the individual case, to keep the temperature within safe limits will soon be learned. In a case of lobar pneumonia, the patient, a boy four years of age, was kept in a pack for seventy-two hours. A continuous pack of 70° F. (21.1° C.) was required to keep the temperature at 104° F. (40° C.) or slightly lower.

The towel or other material employed should not be used for more than six hours, when it should be changed for a fresh one. Another reason for frequently taking the temperature is that early in the attack we do not know how it will be affected by the continued cool applications. In some children it is very readily influenced, and in such a case collapse might follow a very sudden reduction of the temperature. In cases readily controlled, the

pack may be necessary for only one-half hour or an hour, at intervals of three or four hours. An ice-bag may, with advantage, be kept at the head when the child is in the pack.

In ordinary cases a daily warm bath at 90° to 98° F. (32.2°–36.7° C.) may be given, but little friction should be used in drying the body. Such a bath tends to reduce the body heat and to quiet restlessness. If the temperature of the bath be above 98° F. (36.7° C.) or below 90° F. (32.2° C.), there is a liability to depression or collapse. Such a bath obviously cannot be continued very long, and, besides, is likely to frighten the child and render any bathing difficult. Baths between 90° and 95° F. (32.2° and 35° C.) are most agreeable and may be repeated every three or four hours, if need be, without any unpleasant effects. Water at 92° to 94° F. (33.3°–34.5° C.) has a sedative effect, and affords a protection to the central nervous system from reflex irritation.

Hence, bathing should be instituted early, so as to forestall convulsions and delirium. The presence of somnolence, nervous depression, or unconsciousness is not to be construed as counter-indicating this manner of bathing.

Dr. D. S. Hanson, of Cleveland, has strongly advocated bathing in scarlet fever¹ and cites some remarkably good results:

“If a bath-tub be at hand, the patient may be lowered into it lying on a sheet, and a rubber air-pillow placed under the head is a convenience, but neither are a necessity, and my patients have invariably been bathed in an ordinary wash-tub, such a luxury as a bath-tub not being at hand.

“I wish especially to emphasize the early use of the bath, for in these severe nervous cases changes go on very rapidly in the central nervous system. For example: I recently treated a case of cerebrospinal meningitis in which fibrin and pus were present in the cerebrospinal fluid within twenty-one hours from the beginning of the attack, and changes in the foudroyant type of scarlatina are often equally severe and rapid.

“In the toxic type, with high fever, intense rash, great rest-

¹ Jour. Amer. Med. Assoc., Oct. 17, 1908.

lessness, often with double rash, rapid respiration and pulse, often beginning with convulsions and great mental depression, later often with cold extremities and cyanosis, even cases occur in which toxemia is intense, with little or no elevation of temperature, but with marked depression of the nervous system, manifested by delirium, somnolence, apathy, or unconsciousness.

"It is in the early stages of these severe toxic cases where the happy effects of this line of treatment can most frequently be seen, although in cases with high temperature, where these severe nervous symptoms are not present, the benefits to be obtained are nearly as striking and will do more good than any other single measure.

"The method I have used with the most satisfaction is with the water at a temperature of 90° F. (32.2° C.), each bath lasting from five to ten minutes, with very gentle friction to the body surface while in the bath, the bath to be repeated sufficiently often to control temperature and symptoms. Sometimes it has been necessary to do this as often as every two or four hours for three or four days."

"**CASE 1.**—E. W., aged five years. The case was ushered in by a convulsion, vomiting, and diarrhea; the convulsion was immediately followed by somnolence and muttering delirium, temperature very high, and rash beginning to show on neck and chest. The bath was immediately given, and the child conversed intelligently with her father before being removed from the tub. The tubbing was continued as indicated by restlessness and elevation of temperature for three or four days, resulting in a good recovery and no sequelæ."

"**CASE 2.**—E. H., aged three and one-half years, seen the second day of an attack that was of apparently no great severity (rectal temperature not above 102° F. (38.9° C.) at any time) and rash well out, with a pharyngitis of moderate severity, kidneys normal. Her father telephoned that the child seemed disturbed mentally, that she did not seem to understand what was said to her, and was delirious. On my arrival, a half-hour later, she was apathetic, muscles of face twitching, she could not be

aroused from stupor, and was constantly muttering. The bath had as happy an effect as in the last case, the nervous symptoms disappearing like magic. This case illustrates the benefit to be derived in nervous depression when not dependent on high temperature, and must have produced such marked results in some way independent of its effects on the temperature."

"CASE 3.—This was in a child, aged six, rapidly passing into a very dangerous state. Bathing was recommended as the only treatment. The recommendation was accepted and the treatment immediately begun. A bath at the temperature of 90° F. (32.2° C.) was used, with plenty of cold water poured on the head while in the bath. The duration of the bath was fifteen minutes, and was continued every two hours day and night. There was no change the first day, except that the temperature was reduced to and held at 103° F. (39.5 C.). After twenty-four hours' bathing the condition of stupor was much improved. She was now conscious of her surroundings and resisted when put into the bath. She also drank water and a little milk.

"A little medicine was given from now on, but the baths were yet continued day and night. By the fourth day the rash began to appear and was very profuse two or three days later. The throat symptoms were also very severe. The stupor and restlessness soon disappeared and the progress of the case was in every way satisfactory. There were no sequelæ of any kind except five or six abscesses which developed during the period of convalescence."

K. Oppenheimer¹ discusses the treatment of scarlet fever with particular reference to baths and diet. He disagrees with the majority of the German authors, agreeing rather with French and American observers in regard to baths and cold sponging; he does not employ them unless the nervous system is affected. He considers their influence dangerous for the heart, and, more particularly through the possibility of taking cold, for the kidneys. He thinks that cold water, even if applied in the form of packs, is liable to chill the kidneys and lead to nephritis. In the first

¹ Münch. med. Woch., 1908, iv, 1691.

stage of the illness his treatment is purely expectant; rest with plenty of water is probably all the child requires during this time; if the child does not wish to eat or drink, he does not force food, but considers the rest more important. As soon as the child evinces some appetite, milk is given, also diluted tea; later in the disease any food usually given a child is allowed, with the exception of meat, eggs, and their products. He emphasizes that none of the foods must be salted too much. He keeps his patients in bed for from five to six weeks; in the sixth week he permits warm bathing, using a 1 per cent. corrosive sublimate solution for the body. He has never seen a single kidney complication during the last eighteen years, although he has treated in that time more than 150 cases.

If *adenitis* threatens, cold compresses must be promptly applied to the throat and neck, and repeated hourly.

Early bathing favors early *desquamation*, and in older subjects this is a great advantage in shortening the period of communicability. Unusual efforts to detach the skin from the body are not advised. A good method is to soak the soles of the feet once daily in a solution of sodium carbonate (washing-soda) for ten minutes and then in hot soapsuds for the same length of time, after which they are to be rubbed with a coarse towel. The strength of the soda solution should be about 1 ounce of soda to 2 gallons of water. Bathing in this manner favors desquamation and shortens the time of quarantine.¹

Oil Inunctions.—As a substitute for hydrotherapy in scarlet fever inunctions of oil are useful. They are almost always grateful to the patient.

Diphtheria.—In this disease cold gives relief. Powdered ice, enclosed in thin rubber bags, may also be bound over the throat and under the ears.

Similar measures may be used in **parotitis**, although hot applications will generally be found more grateful.

¹ See Pfaundler and Schlossman, English translation; also article on Hot Baths in Scarlet Fever, by H. W. Rorer, Colorado Medicine, July, 1908.

CHOREA

After washing the child's face in cool water, he is placed gently in a tub of water of 90° to 98° F. (32.2°–36.7° C.). This temperature will prove agreeable at the start. The water can be cooled not more than 10 or 15 degrees during the bath. Children can usually be amused for an hour with playthings or floating toys, so that the time will pass rapidly. The bath may last an hour and be repeated once in the day. Toward the end of the bath there should be superficial massage of the arms, legs, and trunk, and after removal from the bath the child will probably take a nap. Success by this method without medication has been reported. Coincident heart disease offers no counter-indication.

Wet packs of from one to one and a half hours' duration are useful in chorea when baths for any reason are not convenient, but wet packs should not be given when there is great weakness, especially of the heart. They should be used in connection with a cold precordial coil after the manner of Buxbaum. The coil should not be applied directly to the skin, nor allowed to remain in place more than thirty or forty minutes at a time, and in some cases less, as the ice-water in the coil may chill the surface, rendering it cyanotic. After fifteen minutes' interval the coil may be reapplied. (See p. 386.)

In a case observed by Kraus an intense and slightly febrile chorea was developed while the patient was under hydrotherapeutic treatment for the relics of subacute articular rheumatism.

CEREBROSPINAL MENINGITIS

Warm baths are indicated in this formidable disease. The water temperature should be 104° F. (40° C.), and the bath may be continued for thirty to forty-five minutes and given three or four times daily. Although the writer has not had any experience in treating this disease, reports of others show that there is a marked amelioration of the symptoms and a decrease in mortality in cases treated by hydrotherapeutic measures.¹

¹ Albany Medical Annals, March, 1905. Article by C. G. Stockton.

To obtain the best results the treatment should be given early. Aufrecht, in 1894, initiated this form of treatment, and Rogansky,¹ in 1904, published the records of 51 patients treated with baths at 104° F. (40° C.) for fifteen or twenty minutes, once or twice a day. Ice-bags were always placed on the head of the patient during the bath. The baths had a marked effect in relieving delirium as early as the first or second bath, and always relieved pain. Of the 51 patients, 34 were cured and 17 died—a mortality of 33 per cent. In the men's ward of the hospital during the same epidemic 50 cases were treated by other means, and the mortality was 80 per cent.

Dr. Alfred Wolisch reports 7 cases, of which 5 completely recovered. Of the deaths, 1 was a foudroyant case, which died within forty-eight hours; the other 4 died in the late stage of the disease, the baths being employed only during the first two weeks.

No statement can be definitely made as to the precise action of the baths, although it is probable that the resulting hyperemia of the skin lessens the amount of blood contained in the brain and spinal cord. It is also likely that in the markedly increased perspiration the toxin which has accumulated in the blood may be eliminated. These baths in the reported cases seem to lower the temperature, to have a toning and regulating influence upon the heart, and to relieve pain and restlessness. They may be used in connection with Flexner's antimeningitis serum with good effect.

The *method* is as follows: The patient is placed in the bath at the temperature of 90.5° to 92.75° F. (32.5°–33.8° C.), and hot water gradually added until 104° F. (40° C.) is reached. While in the bath an ice-bag or a Leiter cold-water coil is placed on the head. The placing in and removal from the bath are done with great care and rapidity; this means close proximity of bath and bed, and both should be at the same level. If there be great tenderness of the back, the sheet may be used to move the patient. The bath must be previously cushioned and thorough after-drying omitted. The patient is placed upon a

¹ Meditsinskoye Obozreniye, October, 1904.

dry sheet, laid upon a woolen quilt, with which he is covered. A light cover is then placed over him, and he is allowed to remain in this position for one hour.

The time of the bath is immaterial—early morning or late evening. Nourishing food, even meat, should be given. Even diarrhea, should it occur, does not contraindicate the bath. Wine, brandy (in milk), also beer are given, for the author regards alcohol as a tonic and hypnotic of the first rank in this disease.¹

The **hot bath** may be given in the *convulsions of children*, but priority should be given to such medicinal measures as the chloral enema, chloroform, or nitrite of amyl inhalations. For the technic see p. 88.

TETANUS

In tetanus the **hot pack** (see p. 341) is a valuable accessory to other forms of treatment.

Warm baths, also, are indicated.

Cold baths were strongly advocated by James Currie as early as 1781, and **cold affusions** by Wright, of Jamaica, who was accustomed to treat tetanus in the West Indies. Currie treated a soldier in February with salt-water baths at 36° F. (2.2° C.), into which the patient was plunged headlong and afterward enveloped in warm blankets and rubbed briskly. The result was most satisfactory after all other measures had failed.

Currie relates other cases successfully treated in this way, and quotes Hippocrates and Avicenna as having used cold baths in the treatment of tetanus.²

The modern treatment of tetanus with **antitetanic serum** and warm baths and packs is more successful than the ancient method of cold bathing.

Yellow Fever.—In the early stage the patient should be given a hot mustard bath or foot-bath. Blankets should be used until free perspiration occurs.

¹ Therapeutische Monatshefte, 1896, Heft 5, S. 254.

² Hippocrates Aphor., 21, liber 5; Avicenna Liber, 3, cap. 7.

Cholera.—In case of collapse the patient should be placed in a hot bath (104° to 105° F.— 40° — 40.6° C.) for ten minutes, and this may be repeated every two or three hours. *Hot wet packs* may be used in place of baths.

INSOLATION; SUNSTROKE; HEAT STROKE; THERMIC FEVER

Hydrotherapy is the sheet-anchor of treatment in sunstroke or thermic fever. The rapid onset and the very high degree of fever demand prompt action, death occurring sometimes within an hour.

The patient should be stripped of clothing and placed on a stretcher covered with a rubber sheet. The head should be slightly raised, an ice-cap applied, and iced cloths, frequently changed, placed about the forehead and neck.

For the excessive temperature, sometimes reaching 106° to 108° to 110° F. (41.1° — 42.2° — 43.3° C.), the patient should be sprayed with ice-water, using a watering-can or syringe with a fine nozzle. A sprinkler provided with a temperature-indicating handle will prove very useful (see p. 245). A cold sheet bath is also excellent. Vigorous friction should be used all over the body and the limbs during the entire time in the sheet or under the spray. Dipperfuls of cold water may be dashed on the patient.

The duration of the bath is, to some extent, regulated by the fall in temperature. When this falls from 106° or 107° F. (41.1° or 41.7° C.) to 102° F. (38.9° C.), or from 108° or 110° F. (42.2° or 43.3° C.) to 103° F. (39.5° C.), the patient may be placed in bed with an ice-cap applied and covered with a thin sheet. Friction of the skin to bring the deeper blood to the surface; the use of ice-water enemata; and, in cases where the pulse is tense and full and the mental state bad, the use of free venesection can be carried out. Later the bath should be repeated. A little cold water should be given by the mouth when possible.

An **ice-water enema** is given as follows: By means of a

rectal tube 4 or 5 pints of water, gradually lowered from 90° to 45° F. (32.2°–7.2° C.), are introduced high up into the rectum and allowed to be retained for about ten minutes. Using the warm water first favors retention, so that a second injection at 40° to 45° F. (4.5°–7.2 ° C.) will not be expelled.

One can give an ice-water enema with a minimum of ice. In India this is a favorite army method and very successful since its introduction by Captain W. A. Heppolette and Captain Foulds. The latter relates his experience with 9 cases of sunstroke occurring when the thermometer ranged from 105° to 115° F. (40°–46° C.) in the shade. These men were taken into the hospital unconscious and with deep stertorous breathing, dry burning skin, and a temperature of 107° to 110° F. (41.4°–43.2° C.). They were stripped and put to bed in the shade. One attendant poured water over them as cold as could be obtained, and two others rubbed the body with ice. An enema of about 1 quart of ice-water was given every ten minutes until the axillary temperature fell to 102° F. (39° C.). All the patients recovered.¹ Six other men were taken into the hospital, drowsy and complaining of pains in the head and dizziness, and with temperatures varying from 103° to 105° F. (39.4°–40.5° C.)—*i. e.*, with all the prodromata of sunstroke. They were treated with ice-water enemata and left the hospital quite well on the following morning.

The time element is very important and there should be no delay. It is better to apply the best measures at hand than to wait to transport the patient any distance. One can certainly loosen the clothing and dash water as cold as can be had against the temples and the throat.² During hot weather ambulances should be provided with ice and water, so that affusions and ice rubbing can be immediately practised. Cases of sunstroke have been lost for lack of any such provision.

¹ Indian Medical Gazette, December, 1906.

² See articles on Treatment of Sunstroke, by Drs. Dryce, G. W. Longen-ecker, R. A. Bachmann, U. S. N., T. H. Ross, G. B. Foster, New York Medical Jour., July 4, 1908; see also p. 245 for technic, and p. 436 of Appendix.

Nitroglycerin hypodermically, by dilating the peripheral vessels, aids hydrotherapy in all such cases. More blood is thereby exposed to cold and a reaction is favored. After spraying it is often a good practice to wrap the patient in a blanket and put a hot-water bottle to the feet.

A great deal has been written about the use of ice-cold full baths and some even advise packing the body in ice. Others use ice rubbing. The latter is somewhat more rational, but ice packing should be condemned. It does not permit of the most important element in the treatment—the vigorous rubbing. The patient will not respond to a too general application of cold: the nerve-centers are too much impressed in severe ceases to react, and, in the absence of friction, the natural recuperative powers are held in abeyance.

Baruch's advice is undoubtedly sound and he has made for years a strong plea for the spray bath and affusions with constant rubbing, recognizing the fact that nerve depreciation is the chief lethal factor; that the nerve-centers are so overwhelmed by the high atmospheric temperature acting on predisposed individuals that the patient is incapable of response to the simultaneous impact of very cold water against the entire body.

Moderation in the use of cold will be the keynote of success in these cases. It is probably the failures resulting from the excessive use of cold in these cases that has led so many hospitals to establish tents outside of the permanent buildings. In many cases of sunstroke treated in these tents very little is done except to cover the patient with a sheet, apply an ice-cap to the head, and sponge with cool water.

In 1896 there was great mortality in New York from heat. Dr. Baruch gives the statistics of 520 cases of sunstroke which were treated in the New York hospitals. Of those who were treated with ice-baths ranging in temperature from 50° to 75° F. (10°–24° C.), one-third were reported to have died; while in 197 cases treated with affusions of cold water, discontinued when the temperature reached 103° F. (39.5° C.), the mortality

was only 6 per cent.¹ The good results of cold-water sponges, affusions, or baths are probably attributable more to a reflex action on the nerve-centers than to the incidental withdrawal of heat. Hence we should not fix our attention on heat reduction, especially from the higher stages of 108° or 109° F. (42.2° or 42.7° C.) to near the normal mark in a single bath, but rather on the moderate use of cold, a better action of the heart and respiration, and on the state of the nervous system.

TUBERCULOSIS

Prophylaxis.—Hydrotherapy may serve a useful purpose in the prevention of tuberculosis. No uniform method is applicable, but the age and general constitution will afford a guide in all measures for the invigoration of the external circulation. A child of two or three years may be gradually accustomed to the use of *cool water* after the warm bath. This cool wash may be applied while the child stands in the tub with the warm water covering the feet, or while lying on the nurse's lap or on a mattress, or a wet sponge may be squeezed over the body. These procedures should be followed by friction. A brisk rubbing for one or two minutes with a wet towel and afterward with a dry towel until the surface is dry and warm is sufficient. Older children may plunge into cool water for from half a minute to several minutes, according to the season, the bath, whether warm or cool, being accompanied by thorough friction.

Cool water bathing must be approached cautiously and with tact, as most children dread it and any sudden or unlooked-for shock will frighten the child. No amount of persuasion will induce him to take a second bath, not to speak of the unfavorable effect on a sensitive nervous system. The child that needs the treatment most will probably rebel the loudest. Cold water and friction presuppose a healthy heart and some strength. It is, therefore, necessary to cultivate a reaction by imperceptible gradations of temperature taken by the aid of a bath thermometer with favorable atmospheric conditions. Dr. Abraham

¹ Medical News, July 24, 1897, Sunstroke in New York in 1896.

Jacobi, who strongly urges this plan of fortifying the system in the young, also points out that the healthy child undergoing this plan of treatment should be given a respite when taken sick or when convalescent from any acute disease or whenever he lacks the necessary vigor. A child under size and under weight and all children under two years of age should be spared a temperature much below the body heat. Children also should not be allowed to go about with knees and legs entirely exposed to the cold of our northern winters.

Whenever the feet after a bath or washing do not warm as quickly as the rest of the body, they should be rubbed with warm water or with a mixture of alcohol and warm water until there is evidence that the constitution is improved and fortified.

Sea bathing and *sunning* on the sand are excellent prophylactic measures when gradually employed and not carried to extremes. The exposure of the limbs and the partial exposure of the body through thin bathing suits to the action of sun and air, developing tan and increasing the tone and natural resistance of the skin, constitute the best safeguard known against tuberculous disease, whether in the bones, the glands, or the lungs. Sea bathing may thus be employed as a preventive measure. In a suitable marine climate we may have a prevention sanatorium or a *preventorium*, as it has been called, in which hot and cold sea-water baths are afforded. Surf bathing would probably be dangerous for cases of pulmonary tuberculosis, but tub-baths with sea-water rubbing would doubtless be attended with benefit. *Salt rubs*, in which cloths or the bare hand, after being wet in warm water, are dipped in finely ground salt and then rubbed over the body, are also appropriate.

Cornet's method of hydrotherapy in tuberculous cases involves the use of a 5 per cent. solution of salt (twice the strength of sea-water) at 90° F. (32.2° C.). A sensitive patient, in the winter, begins with ordinary rubbing by an attendant morning and evening. No water is used at first. The patient is put into a large coarse sheet on a firm bed and rubbed with long quick strokes from head to foot, so that a strong glow may be brought

to the skin. In a week or so this is modified by rubbing the trunk and members with a wash-cloth wrung out of water, which in successive application is lowered from 92° to 66° F. (33.3°–18.9° C.) until there is a ruddy reaction. The patient is then covered and permitted to rest for half an hour. This treatment may be given daily and preferably before breakfast on an empty stomach; but weaker patients may have a glass of warm milk, or coffee or tea half an hour before; or the patient may take a short walk or have a dry rub previously, so as to favor a good reaction.

If the preliminary treatment has been found satisfactory, the following program may then be adopted regularly: The patient, entirely nude, is wrapped in a linen sheet wrung out in 5 per cent. brine at 90° F. (32.2° C.), so applied that it comes in contact with the entire body. As the course of treatment progresses the sheet may be applied dripping from the brine. The patient is then rubbed by a trained rubber, with long powerful strokes, until there is an agreeable feeling of warmth over the entire body. A cloth wet in cold water may be laid on the head to prevent headache. The rubbing lasts but one or two minutes, after which the patient is laid on a dry sheet and again rubbed. He dresses without delay and goes out into the open air for at least half an hour. After this walk he takes breakfast. Weaker patients get into bed for at least half an hour. The temperature of the brine is lowered 1° F. (.54° C.) with each application, until 70°, 65°, or even 60° F. (21.1°, 18.3°, or 15.6° C.) are reached.

The full rub should be done quickly, expertly, and energetically, and preferably by a trained attendant. Experience will show how headache, discomfort, and chilliness may be avoided.

Douches may be used, but Cornet limits them to those who are fairly strong and then only in the physician's presence. The temperature should be from 90° to 95° F. (32.2°–35° C.) or warmer. The patient must rub himself during the douche. After he is dried, he dresses himself and walks in the open air. Irritable cases and those with much sputum are not suitable for the douche, as forced breathing and aspiration of sputum may result. These rubs harden the body and render it less susceptible

to changes of temperature. With the douches they are a neuro-vascular stimulant, improving the "peripheral heart," enhancing the appetite, nutrition, and general mental condition.

Baruch permits the **initial use of colder water** and reduces its temperature more quickly. The first step is a thorough cleansing with soap and warm water. On the second day the patient is wrapped snugly in a thin blanket and allowed to lie half an hour or longer unless he perspires. If the rectal temperature be above 100° F. (37.7° C.), the treatment is omitted, and in afebrile cases additional blankets may be used, so as to dilate the cutaneous arterioles preparatory to being treated with water. The face is bathed with water at 50° F. (10° C.). The blanket is then opened over the chest and abdomen and these parts rapidly and well rubbed with water at 75° F. (23.8° C.). After drying, the patient is turned on his abdomen and the back is similarly treated. The limbs are not treated. The patient is dried gently, dressed, and, if afebrile, he is sent into the open air for a short walk. Febrile cases are returned to bed. The treatment is repeated daily and the water lowered 2° F. (1.08° C.) at each ablution until 60° F. (15.6° C.) is reached. When this stage is reached the ablution is performed as follows, just as the patient emerges warm from the bed:

Standing in a foot-tub containing sufficient water at 100° F. (37.7° C.) to cover the feet to the malleoli, the patient receives a rapid friction bath with water at 90° F. (32.2° C.), omitting the upper extremities. He is then dried and sent into the open air if his rectal temperature be below 100° F. (37.7° C.). The water temperature is reduced daily 2° to 5° F. (1.08°–2.7° C) until 60° F. (15.6° C.) is reached, when the ablution is replaced by affusion. This consists of pouring four basinfuls of water at 90° F. (32.2° C.), previously held in readiness, over the body. Water is dipped from a vessel and poured with force over each shoulder, the back, and front of the chest. Rapid drying while standing on a warm towel completes the procedure. Beginning with a water treatment at 90° F. (32.2° C.) it is reduced daily by a few degrees until 60° or 50° F. (15.6° or 10° C.) is



reached. This refreshing process may be repeated daily. In febrile cases Dr. Baruch states that the temperature should not fall below 65° F. (18.3° C.).

At the Adirondack Cottage Sanitarium, Dr. Lawrason Brown states in a private communication to the author that some of the patients throughout the winter take cold sponges and some cold plunges, but he does not advocate very strongly a plunge into such cold water as flows from the faucets in winter, in the neighborhood of 40° F. (4.5° C.). His patients are treated usually



Fig. 23.—Morning douche of cold water. The tuberculous patients at the Pine Ridge, R. I., sanatorium or camp were accustomed to take this douche. Photograph taken in March, 1905, for the author, by Dr. W. H. Peters.

along the lines laid down in Dr. Brown's chapter on the treatment of pulmonary tuberculosis in Osler's "Modern Medicine," vol. iii, but such measures are not advised, except in a very moderate form, if there be heart disease, aneurysm, or marked arteriosclerosis.

The bath should be taken in a room never below 55° F. (12.8° C.), and the lower half of the body should be kept clothed while the upper half is being cleansed with water at 100° F. (37.8° C.). Cold water, 40° to 60° F. (4.5°–15.6° C.), should be applied with a sponge to the neck, to the front and back of the

chest, and to the arms for from one to two minutes. The body is then dried with a coarse towel. In cases unaccustomed to a morning bath, it will be best to use tepid water at 80° to 100° F. (26.7°–37.8° C.) instead of sponging at 40° to 60° F. (4.5°–15.6° C.), gradually reducing the temperature each day until the latter temperatures are reached. In other cases it is best to begin with sponging one arm, then on the following day both arms, and so on until the body to the waist has been sponged. Alcohol rubs or salt rubs may be substituted in special cases. For more vigorous patients the cold plunge at 50° to 70° F. (10°–21.1° C.) may be permitted, or the cold shower, or the full cold sponge while standing in warm water. In winter these measures are to be modified if they increase nervousness. These morning baths and sponges, however, are in no sense a substitute for a bath twice a week in water at 100° to 105° F. (37.8°–40.6° C.) with a free use of soap.

In febrile cases great care should be taken to avoid any exhausting hydrotherapeutic measure. Dr. Brown advises a salt sponge in the evening, followed by an alcohol rub. This refreshes the patient and induces sleep. If the patient be weak, alcohol may be added to the salt water. If the sponges fail to reduce the temperature sufficiently, an ice rub may be given or a cold pack to the trunk. An ice-bag over the heart frequently quiets the nervous system. If patients fail to react or feel chilly, it will be well to try dry rubbing and on subsequent days sponging with warm water, gradually reducing the temperature. A little food or hot drink should be given before the morning bath. In sponging with salt water, $\frac{1}{2}$ ounce of salt to the quart of water will be sufficient.

Advanced febrile cachectic patients, or those with a tendency to hemoptysis, should never be sent to a spa; but saline waters, such as Congress or Hathorn, are sometimes valuable in relieving the catarrh of quiescent, torpid, or anemic patients.

When **cough** is distressing, a local cold compress to the chest is useful. The cross-binder of Priessnitz and Winternitz may be applied during the night to relieve pleuritic pains, bronchial

catarrh with tenacious sputum, and persistent cough. Sleep is thus favored.

The *cross-binder* is applied as follows: Take several strips of linen or cotton cloth 3 or 4 inches wide and 20 to 24 inches long. Dip in cold water, pass over each apex, and hold in place by a strip 6 to 9 inches wide encircling the chest. These strips should be covered with a 3-inch flannel bandage closely applied. Oiled paper, muslin, or silk may be used under the flannel bandage, but it is not necessary. When removed in the morning the chest should be sponged with cold water. If patients do not react to the cross-binder, they should be rubbed with or without alcohol until warm before reapplying the cross-binder.

Tuberculous patients are liable to neurasthenia, and hence great tact is necessary in instituting new measures.

Pulmonary Hemorrhage.—It has long been known that cold applied to a distant part will control a pulmonary hemorrhage. Currie (1797) refers to this, stating that he found that hemorrhage from the lungs may be stopped by immersing the feet in cold water, or, better still, by applying it permanently to the scrotum and genitals, "which part with their heat more easily than any other portion of the body." He also obtained a more powerful effect by immersing the body up to the pubes in cold water.

Cold applications by means of ice-bags may also be made to the chest or to the thighs, this causing a contraction of the pulmonary vessels by reflex action. It is the experience of Kraus, Brehmer, and others who have used hydrotherapy in tuberculosis that hemoptysis is never produced by these measures.

A case was recently reported by Downes, in which a man lost by hemoptysis as much as $153\frac{1}{2}$ ounces of blood in nine days, the greatest amount in one day being 31 ounces. The usual methods employed for checking hemoptysis proved futile, but immediately on applying an ice-bag over the suspected lung all bleeding stopped, and not a single drop of blood was expectorated from then on. All drugs were stopped and the ice-bag kept in place for six days.

PNEUMONIA

This disease has gradually taken first place in the mortality lists of our largest cities. In New York City it has been the leading cause of death for seventeen years, and for seventeen years had been second only to tuberculosis. The methods of treating pneumonia have changed considerably in recent years, and a larger consideration is gradually being given hydrotherapeutic methods. No matter what the plan adopted may be, the mortality rate in hospitals remains very high, from 30 to 40 per cent., alcoholic cases included. In private practice, however, the rate is much lower. Those who have used hydrotherapy, and especially cold applications, have met with better success, and, considering the extraordinary reports, it is a matter for wonder that the methods adopted have not been more generally employed.

Cold.—Without reviewing the use of drugs, venesection, and the expectant treatment that have had more or less popularity, we would refer more particularly to the use of cold. In pneumonia this is applied by means of ice-bags, snow, cold compresses to the affected chest and to the head, or by means of the Brand bath, as used in typhoid fever. The fact is that pneumonia and typhoid fever respond in very much the same manner to hydrotherapy. Both these infections are met by the same reparative processes, the full power of which is brought out and reinforced by thermic stimulation. The fact that one infection selects the lung and the other the intestine has nothing to do with the propriety of similar methods of treatment.

The main object of treatment in pneumonia is the preservation of the full and efficient action of the *heart* and the *peripheral circulation*. Heart failure is the principal cause of death. In all infectious diseases it should be our aim to improve the circulation in the cutaneous arterioles, and our best agent is undoubtedly thermic stimulation by methods which will be described further on. The danger of hyperpyrexia is not so much degeneration of the heart muscle, as interference with the peripheral circulation.

Clinicians are constantly warning against the use of *drugs* to counteract hyperpyrexia. Undoubtedly much harm was done during the earlier years after their introduction and later by acetanilid mixtures masquerading under trade names. Alcohol, also, excepting in cases where the heart is failing, is not employed nearly as freely as formerly, excepting in pronounced alcoholic cases. Strychnin has also been abused in this connection, and all these measures when used to excess are more or less embarrassing to the struggling heart. Remedial agents directed to the skin and the vasomotor system are more rational, and not only prepare the way for cardiac stimulants when needed, but also enhance their action.

The application of *cold to the thorax and to the head* profoundly affects the *heat regulating centers* of the body. These are located in the cortex and at the base of the brain. The derangement of their functions by the products of infection produces fever. The respiratory centers share in this derangement, resulting in the quick breathing so characteristic of pneumonia and other infections, partly central and partly reflex in its origin. When the infection is intense or when from any cause the heat-regulating centers are unduly stimulated, the neighboring convulsive centers are aroused, giving rise to the convulsions of febrile diseases.

The early use of cold applications to the head and chest in pneumonia is, therefore, demanded to mitigate the effects of the toxins on the central nervous system. It is conservative: while sparing the nerve-centers it favors the better distribution of the blood in which are generated those antitoxins, and the so-called *antibodies*, which swallow up the invader.

Cold applications, therefore, to the brain and to the base of the brain are rational in connection with similar applications to the thorax. They reduce restlessness and irritability or prevent them altogether, and reinforce the effect of cold applied to the chest.

Dr. Thomas J. Mays,¹ of Philadelphia, seventeen and eight-

¹ Medical and Surgical Reporter, Dec. 19, 1906. See also Med. News, Philadelphia, Sept. 24, 1892; June 24, 1893; Oct. 13, 1894.

teen years ago published reports on the local application of cold in acute pneumonia with an analysis of 299 cases treated in this manner by physicians residing in nearly all parts of the United States. This was a remarkable collection, as the cases were distributed from the Atlantic to the Pacific coast, and only 10 deaths were reported, the death rate being 3.35 per cent.

Of course, in a collective investigation of this kind, where reports are requested, the tendency is to bring forward successes and withhold failures, so that some allowance must be made for the natural tendency of the human mind to respond with favor-



Fig. 24.—Application of the cold-water coil to the chest in croupous pneumonia or pleurisy. Leiter coil (Hare.)

able data on a given subject. But with all due allowance for the natural tendency to bias in such a collective investigation, a most favorable conclusion is reached as to the value of the local application of cold in acute pneumonia.

As an evidence of the character of the cases in which cold was used, ice being the medium employed, and in testimony to the favorable impression both on the part of the patients and their physicians, Dr. Mays published an additional report of 195 cases with 7 deaths.¹

¹ The Local Application of Cold in Acute Pneumonia, by Thomas J. Mays, Trans. Phila. County Med. Soc., vol. xvi, 1895.

In the **pneumonia of infants** and young children a moderately cool wet pack is useful (see p. 340). Cool spongings are sometimes employed, but they require manipulation and are more likely to disturb the patient than is the pack. They are ineffective if there be a high temperature. It should be distinctly understood both in reference to children and adults that natural sleep is not to be disturbed by any hydrotherapeutic measures. Ice-bags have the advantage of causing less interference with the bodily comfort and quiet of both children and adults, and are used successfully with children as young as two or three years, taking care that the bag is not applied directly to the skin. The ice-bags must also be removed at intervals to avoid local cyanosis, for on rare occasions devitalization of the parts to which they have been applied has occurred. One such case is recorded in France, and recently a suit for damages has been brought in which it is alleged that proper precautions were not taken to prevent this accident. (See page 386.)

Dr. B. Buxbaum,¹ of Vienna, is a strong advocate of **cool half-baths** at 65° to 72° F. (18.3° to 22.2° C.) for not over five minutes, with active frictions and affusions. He also uses the chest compress or cross-binder (Stammusschläge) and warm packs to the lower extremities. The chest compress is put on cold and changed every two or three hours. He rightly insists that it is not the high temperature that must be combated, but the weakness of the heart, the nerve changes, the congestion, and hyperemia of the lung.

The best treatment of very young children is by cold compresses or sponging. The compresses should be wrung out of water at 75° to 80° F. (23.3° – 26.7° C.). If sponging is adopted and the child does not react from a cold sponge, a luke-warm sponge should be given. In some cases it will be impossible to sponge at all, and then compresses are usually better borne. They should be applied from the neck to the umbilicus.

¹ B. Buxbaum, Die Hydrotherapie der Pneumonien im Kindesalter, Deutsche Medizinal Zeitung, Feb. 4, 1897; and Blätter f. klin. Hydrotherapie, 8, 1896.

A full wet pack is also sometimes used with success. It adds to the child's comfort, improves sleep, diminishes the respiration, and strengthens the heart. The Brand bath is not to be recommended in children.

In **adults** the compresses should be colder and the following procedure is advised: A large towel may be folded lengthwise in the middle, then crosswise in the middle. One-half of the length of this four-ply towel is wrung tightly from ice-water or the coldest water obtainable, and again folded crosswise, so as to give four thicknesses of wet towel inside and the same of dry towel outside when applied to the chest. The damp folds should be freshened as often as they become the least hot, whether this be in ten, twenty, or thirty minutes. Probably at first in severe cases changes will be as often as eight or ten minutes, the intervals lengthening more and more as the inflammation subsides, and breathing consequently becomes deeper and easier.¹ As the breathing becomes more natural and the compress fails to become hot, the applications may cease. The ice-bag should be applied if pain is persistent. Abundance of water should be given internally; if not borne by the mouth, enemas may be substituted.

When the secretions are checked and the skin hard and dry, with the tongue dry and brown, the pulse weak and rapid, and the respiration shallow and quick, and subsultus indicates depression, great benefit may sometimes be obtained from the administration by hypodermoclysis or high rectal enemas of $\frac{1}{2}$ to 1 pint of decinormal salt solution, or, better, the normal salt solution to which has been added a small quantity of a calcium salt. Ringer's solution may be employed for the purpose. It consists of a 1 per cent. solution of calcium chlorid, 3 parts; a 1 per cent. solution of potassium chlorid, 4 parts; a 1 per cent. solution of sodium chlorid, 70 parts; and distilled water, 23 parts.²

In dealing with an infection like pneumonia every effort should be made to get rid of the toxins and prevent any exten-

¹ C. E. Page, Medical Record, December 23, 1905.

² See Prognosis and Treatment of Croupous Pneumonia, Jour. Amer. Med. Assoc., Nov. 22, 1902.

sion of the bacterial invasion. Fortunately, relapse is rare in pneumonia, and this is an evidence that natural protective anti-toxins are usually sufficient to limit the disease at least to one lung. In promoting elimination we should pay more attention to the skin and bowels than to the kidneys, as there is always danger that the circulation may fail. In acting on the skin we may supplement the action of a failing heart, and hence measures that promote sweating are not only safe, but imperatively demanded. They may be used in connection with the cold applications to the chest which we have referred to. To promote sweating is to facilitate nature's method of combating infectious diseases. In connection with a free action of the bowels it is an aid to recovery. A most rational method of treatment has been practised by Dr. De Lancey Rochester with great success.¹ We give his method, which he has earnestly advocated for many years and which is well worth attention. The first indication is to relieve toxemia; the second, to prevent failure of the heart; the third, to prevent complications as they arise.

As already stated, we should not attempt to stimulate the kidneys to excessive action, especially if in a state of acute inflammation. This is worse than useless, so the use of stimulating diuretics is positively contraindicated.

The bowel and the skin remain, and nature has shown by the profuse sweat at crisis and the occasional critical diarrhea that these are the avenues that are preferred.

So our first indication in treatment, the relief of toxemia, may be met by induced sweats and mild catharsis. The mild catharsis is best produced by the administration of calomel at the onset of the disease, to be followed by the use of a saturated solution of Epsom salts in moderate dose daily. The calomel dose may be repeated occasionally as the indications arise. The sweating is best and most easily induced—not by the administration of drugs—but by the hot mustard foot-bath scientifically

¹ Medical News, February 13, 1904; Jour. Amer. Med. Assoc., November 9, 1901.

given in bed with no disturbance of the patient. Much depends upon the proper method of giving this bath.

The patient, in a nude condition, lies between blankets with his knees flexed, his feet in the tub which has been introduced under the upper blanket, the long axis in the line of the patient's body and legs; another blanket passes from under the tub up over the end and over the knees of the patient; two to five blankets or a smaller number of blankets and a rubber sheet are then placed over the patient, extending from the neck of the patient over the foot of the bed and tucked in around the foot-tub and side of the patient. The tub at first is filled half full of hot water in which a heaping tablespoonful of mustard has been dissolved. From time to time during the bath more hot water is added, care being taken that the water is poured against the side of the tub and stirred in by the hand of the nurse, in order to avoid burning the patient's feet. The bath is kept up from thirty to forty-five minutes, according to the amount of sweating produced. During the administration of the bath cloths wrung out of ice-water are kept constantly on the head of the patient. This sweating in connection with the stimulation, to be referred to later, is, in Dr. Rochester's opinion and that of the writer, the most important of the general therapeutic measures.

In treating pneumonia, just as in the case of typhoid fever, we must recognize again the remedial power of fever, and not be in too much haste to check it by intense hydrotherapeutic measures. The toxemia of pneumonia is rarely so intense as in typhoid; moderate fever is not fraught with danger, and unless the temperature exceeds 103° F. (39.5° C) it probably aids the destruction of the specific virus. Indeed, it has been claimed that cases of lobar pneumonia, in which the temperature pursues a comparatively low range, do badly as compared with more febrile symptoms. This, however, we do not fully believe.

Dr. Jacobi says of high temperatures: It is understood that a high temperature is not a uniform danger. In persons suffering from an old heart disease, in the prematurely born, in the anemic of all ages, it is so, or may be. Whether a warm bath,

or a warm bath gradually cooled down, or a cold bath, or cold washing and sponging and friction, or a warm or a cold pack over chest and abdomen are indicated, or the local application of an ice-bag, depends on the individual case and the individual doctor. Forty years ago¹ I could speak of a fair experience with cold water in typhoid fever, pneumonia, scarlatina, variola, ophthalmia, diphtheria of the conjunctiva, heart diseases, local inflammation, phlegmon, synovitis, and peritonitis. It has served me well since. No uniform rules fitting every case of pneumonia can be given. It takes brains to treat lungs.

Deléarde gives revulsion as the primary indication in the treatment of bronchopneumonia and capillary bronchitis in children. It should be applied energetically four times every twenty-four hours throughout the diseases until the fall of temperature and the disappearance of the principal signs. The methods recommended are sinapisms and hydrotherapeutics. The mustard leaf may be made use of, but a much more effective application is made by wringing out a napkin in a thin mustard paste and enveloping the chest in it. The child is then wrapped in flannels and left for fifteen minutes. After this he is unwrapped and bathed in warm water to remove the loose mustard, and dressed and put to bed, when he usually goes to sleep comfortably. This should be repeated two or three times in twenty-four hours. The rubefacient effect lasts several hours. The mustard bath also produces a good revulsive effect. This form of application is appropriate when the extension of the lesion gives us a bad prognosis, rather than degree of the infection. Two sinapisms and four hot baths at 38° C. (100.4° F.) may be given daily. When the involvement is small in area and the infection severe the prostration would be increased by hot baths, while cold baths will lessen it and stimulate the child, lessen pulse tension, and increase diuresis. Cold packs have the same effect. When natural sleep occurs, no hydrotherapeutic measures ought to be used.

¹ Med. Record, 1870.

ASPHYXIA NEONATORUM

Asphyxia neonatorum calls for hydriatic measures. The child should be given rather vigorous vibrations, swinging or shaking movements, rubbing the chest with cloths wet in warm water, clapping the soles of the feet. Efforts should also be made to get the mucus from the throat, and the child should be placed in a warm bath at 90° F. (32.2° C.). The bath should be of short duration, varied with cool douches or dashes of cool water. After repeated efforts, slight and irregular breathing may be established in cases which will not yield to other measures. As the efforts are continued, the breathing is gradually established.

ACUTE BRONCHITIS

In acute bronchitis the hot mustard foot-bath or full bath, described on pp. 106 and 291, should be tried. A time-honored measure is the Priessnitz pack or cross-pack about the whole chest. It relieves pain and especially dyspnea and cough. The pack should be made from water at 45° to 55° F. (7.2°-12.8° C.) and renewed every two hours by day, but may be left unchanged at night in order not to disturb rest, renewing as opportunity offers. For adults, cold douches to the chest may be used.

Steam Douche to Promote Expectoration.—Lissauer¹ has been using for a year a method of stimulating the secretions, which has proved very effectual and harmless in his hands. A spray of steam at a temperature of from 110° to 125° F. (43°-52° C.) is sprayed rapidly over the upper part of the body for fifteen seconds, followed by a cold fan douche for three or five seconds, after which the patient is rapidly rubbed down and dressed. He cites 16 cases in detail to show the prompt effect on the expectoration induced by this procedure. It does not produce much of an appreciable reaction on the skin, but the patients feel the relief very soon.

Mustard Packs in Bronchitis.—Mustard may be used as a

¹ Deut. Med. Wochenschrift, xxxii, No. 7.

counterirritant in the treatment of capillary bronchitis and bronchopneumonia in infants and children. Dr. A. Herzfeld, of New York, has been using a method devised by him for the past thirteen years with great advantage. It is as follows: 250 ccm. of water and 250 ccm. of alcohol are mixed in a large bowl; to this are added from 25 to 50 ccm., according to the severity of the case, of freshly prepared spirit of mustard. The spirit of mustard is prepared, according to the German Pharmacopœia, as follows: Oil of mustard, 1 part; pure alcohol, 49 parts. A large piece of flannel is moistened with the mixture and wrapped around the child from the neck to the knees. The child is then enveloped in a dry sheet, and the pack is left on until the skin is a bright red, usually in from fifteen to thirty minutes. The child is then taken out and wrapped, and left for another half-hour in a pack wet with 1 part alcohol and 2 parts water. At the end of this time the child is wrapped in a dry sheet. Usually one pack causes marked improvement, but relapses are frequent, and it may need renewal. Once in twenty-four hours is enough unless the indications are unavoidable. The physician should apply the first pack himself, to determine the strength needed, and to instruct the parent or nurse. Dr. Herzfeld sums up the advantages of the method as follows: It is surprisingly rapid in effect. Its light weight does not materially embarrass respiration. It can be applied without removing the enfeebled patient from the bed. It is inexpensive. It is clean.¹

ACTIVE CONGESTION OF THE LUNG

In active congestion of the lung, without evidence of an oncoming pneumonia or other serious disease, the overfilling of the blood-vessels may often be corrected by hot applications and counterirritants. Many clinicians use a hot bath at 106°, 108° or 110° F. (41.1°, 42.2°, or 43.3° C.) for ten minutes. The warm pack may be used, and, if necessary, this may be preceded by a hot bath. If the two measures are used, the bath may be short-

¹ Jour. Amer. Med. Assoc., January 9, 1909.

ened to five or six minutes. It is best to bring the bath gradually up to the maximum after the patient is in the tub.

Sweating processes are indicated as described in the treatment of pneumonia (see pp. 105 and 106).

EDEMA OF THE LUNG

In edema of the lung the mustard pack is highly recommended by Lenhartz, applied after the following plan:¹ 1 to 3 pounds of mustard are taken and a pap is made by the addition of a sufficient quantity of lukewarm water. This is spread upon a sheet, laid upon a blanket, and the patient is then wrapped up in both, so that the extremities, trunk, and neck are thoroughly covered, the eyes being protected from the fumes by tucking the blanket in at the chin.

The patient remains in the pack from twenty to thirty minutes and is then washed off with lukewarm water.

Carbonic acid baths ought not to be given when there is any tendency to pulmonary edema.

INFLUENZA, EPIDEMIC CATARRHAL FEVER

In this disease hot applications give more relief than cold ones. They should take the form of hot or warm baths; and the use of cold cloths to the head, whether in or out of the bath, should be repeated in accordance with the comfort afforded.

ASTHMA

Bronchial asthma due to nasal reflex is amenable to treatment by cold applications. Cold water may be poured over the back of the neck or applied in the form of a cold douche under a pressure of 10 or 12 pounds and for only a few seconds. This is an application of the principle enunciated by Winternitz; namely, that the use of cold or heat by reflex action modifies the lumen of the blood-vessels through the vasomotor and respira-

¹ The Prophylaxis and Treatment of Internal Diseases, Forchheimer, p. 340.

tory centers. The same effect is not realized by the application of cold elsewhere on the body nor by mere cloths wrung out of hot water. The mechanical stimulus of the poured water seems to be an important element in the relief experienced.

Before dressing in the morning the simple application of the cold douche to the back of the neck gives great relief in chronic simple rhinitis, and may relieve the suffocation in asthma.

RENAL DISEASES

The use of hydrotherapy in renal diseases, especially in conjunction with the administration of water internally, has held a well-deserved place in therapeutics for ages. Nearly every spa and every mineral water has been advocated for this class of affections. But the forms of renal disease are so various and the different stages of the same affection exhibit such different pathologic conditions that the subject seems to become more complicated and more confused as more light is thrown upon it. Physiologists and clinicians are by no means agreed on some of the main points involved in the hydrotherapy of renal disease, points on which great stress is usually laid in explaining the action of the baths.

SWEATING

Aside from the subject of the use of waters internally, allied so closely to hydrotherapy and about which there is a radical difference of opinion, the action of water on the skin involves questions on which well-known authorities differ. It is commonly believed that the sweating process which precedes, accompanies, or succeeds the bath, while relieving the kidneys of some of their functions, carries off in the sweat certain toxic substances, thereby causing the skin to eliminate what the diseased kidney is unable fully to accomplish. In other words, the skin acts vicariously for the kidneys as an excretory organ. But this view is not accepted by some of those most competent to judge, and such men as Senator and von Noorden, in Europe, and Croftan and Ransom, in America, are on record as opposed

to this theory.¹ Senator says: "Warm baths are useful in removing excess of water, but the specific urinary constituents, which are the mischief makers, are not removed in any appreciable quantity even by the most profuse sweating." von Noorden holds that the only benefit of sweating lies in the withdrawal of water from the blood and tissues. He and his pupils have demonstrated that the perspiration of nephritis contains only a trace of urea—the maximum is about 1 to 1.3 gm. in the total quantity of profuse sweat, while the remaining constituents are but harmless substances. He further states that poisonous substances in the sweat have never been found. Both von Noorden and Croftan express themselves decidedly against the practice of giving large amounts of fluid during the sweating process, considering it both irrational and harmful. "It is impossible to eliminate any toxic substances in this manner; the existing edema is not relieved and may be increased, thereby adding to the burden of the enfeebled cardiovascular system; and, finally, the kidneys are in danger of being further irritated in the endeavor to excrete the excess of ingested water" (Ransom).

On the other hand, Winternitz says in this connection: "The secretion of sweat certainly undergoes considerable augmentation. The small amount of organic matter eliminated at the same time, the trace of urea, the various fatty acids, and the numerous aromatic substances, as well as gases, particularly carbon dioxid, should certainly be given consideration in this connection. That toxic substances, probably various kinds of infectious matter, and even micro-organisms, may leave the body with the sweat, has already been demonstrated by numerous investigators. The depurative action of the sweat is in this way revived in the modern sense."²

The experiments of Frey and Heiligenthal at the sodium

¹ A. C. Croftan, *Jour. Amer. Med. Assoc.*, June 24, 1905; C. C. Ransom, *ibid.*; Senator, *ibid.*, 1906; von Noorden, *Nephritis*, English translation, E. B. Treat & Co., 1905, pp. 48 and 56.

² A System of Physiologic Therapeutics, vol. ix, p. 37, by Wilhelm Winternitz, P. Blakiston's Son & Co., Philadelphia.

chlorid springs at Baden-Baden, where steam baths are given at a temperature of 122° F. (50° C.) for half an hour, are here of interest. These experimenters noticed a primary brief transitory contraction of the capillaries of the skin, and, as a result, increased pressure in the arterial system and moderate acceleration of the pulse; then a secondary dilatation of the capillaries, reduction in blood-pressure and cardiac vigor, and further acceleration of the pulse. Perspiration occurred in the bath. On the days of the bath there was a reduction in the amount of urine, an increase in the elimination of urea and uric acid on the first day, and an increase in this elimination on the next succeeding days. Beneke has shown that cold sea-baths increase the elimination of urea.

Although in a case of extreme sweating as much as 1.3 gm. of urea have been recovered from the sweat, as a rule the skin does not excrete toxic substances, but the essential waste products are passed off through the urine and the bowels. The credit of secretion belongs almost entirely to the liver and the kidneys.

The beneficial effect of sweating lies in the removal of an excess of water, thereby relieving the circulation of an added burden during the time the kidneys are congested. When these organs resume their function, it is probably unwise to continue diaphoresis with the hope of reducing the albuminuria. Ransom says that sweating has no effect whatsoever in lessening the albuminuria, as the debilitating effect of the profuse sweating will not be compensated for by any good that may come from it. Besides, when the kidneys become active, it is best to have the urine as little concentrated as possible, in order to reduce the possibility of irritation from the increase of solid matters.

Ransom further holds that patients suffering from acute nephritis and chronic nephritis of the parenchymatous form should not be sent to the springs. The various hydrotherapeutic procedures which are useful in the treatment of acute cases are easily carried out at home, and none of the advantages obtained from the spa treatment for chronic nephritis results to patients in the acute forms of the disease.¹

¹ See von Noorden on Nephritis, *op. cit.*

CHRONIC INTERSTITIAL NEPHRITIS

We thus see that by the exclusion of the above-mentioned classes we have left the cases of chronic interstitial nephritis regarding the hydrotherapeutic treatment of which all authorities agree. It is pre-eminently in the case of the gouty type in which cardiovascular changes have preceded the actual changes in the kidney that baths will do most good. These patients complain of circulatory disturbances, gastric disorders, gradual loss of strength, and anemia. The urine has a low specific gravity, is abundant in quantity, and deficient in urea. Albumin and hyaline casts are present. Patients of this type may have a high arterial tension, but this fact need not debar them from the use of baths under proper precautions.

Carbon dioxid, or so-called artificial Nauheim baths, may be employed in cases of this type. At the outset it is best to use salt baths containing only a small amount of carbon dioxid. Permanent lowering of arterial pressure has been noted after this method of treatment. (See p. 319.)

The **associated drinking cures** at Spas are highly beneficial in these cases, particularly when alkaline, alkaline calcic, or magnesium sulphate waters are available with little or no sodium chlorid in their composition. Sulphur springs are useful in many cases, the water being applied both externally and internally. Physicians practising at sulphur spas claim that great benefit is derived from the baths through their stimulating effect upon the glandular system and upon cellular activity; nutrition is improved and perverted metabolism is corrected. The stimulating effect of this class of waters upon the skin also tends, to a certain degree, to improve the tone of the circulation.

In cases of marked **arteriosclerosis**, baths should not be given except with the utmost care, but in cases of high tension without arterial change, baths always do good. There is often a high-tension pulse where there is no arteriosclerosis, and it is rather common to observe patients in whom there is a high nervous tension. It is in these cases that the full warm bath for eight or ten minutes, followed by a rain bath for five or six sec-

onds, or a fan douche, will prove eminently useful by allaying nervous irritability. These are the neurasthenic cases, for which treatment is outlined on pp. 162 and 163.

Hot Applications.—In treating chronic nephritis, hot applications are preferable to cold, the latter producing a peripheral contraction of the blood-vessels before the ensuing dilatation. A. C Croftan¹ has recently called attention to this subject, and claims that, in predisposed subjects, the primary contraction may rupture weakened vessels, and, by increasing the heart's action, thus temporarily increases vascular pressure. In chronic nephritis the reaction may fail altogether, owing to a lack of vascular tone or changes in the heart muscles or those of the peripheral arteries.

For reducing vascular pressure hot applications are more lasting in their effect, as deeper vessels become dilated. Moist heat is best unless there be need to avoid edema. The claim is made that dry heat abstracts so much water from the blood that the toxins become concentrated. This is a theoretic objection that is not sustained by experience.

Electric-light Baths.—Pratt treated a woman with chronic nephritis who had been ill a year. She had marked general anasarca and the day urine contained over 1 per cent. of albumin. The essential features of the treatment instituted were electric-light baths and a salt-free diet. She objected strongly to the diet, but did not abandon the plan of treatment because she felt that the light baths were beneficial. After three months the edema had disappeared except for a slight swelling of the legs. When last seen, three years later, the edema had not recurred and the urine contained only a slight trace of albumin. It is probable that her recovery was due more to the salt-free diet than to the light baths, yet without them she never would have continued with the diet.

Dr. Pratt adds that in *nephritis* with *edema*, the electric-light bath furnishes the best form of sweating procedures. The duration should not be more than thirty minutes. It should

¹ Medical Fortnightly, March 23, 1906.

be followed by a dry blanket pack if the edema is marked and the patient not enfeebled. A hot douche may end the treatment.

It is well to use short light baths followed by mild douches in *subacute* and *chronic nephritis* to keep the sweat glands active and to aid in maintaining the normal condition of the heart and circulation. As most authorities hold that cold applications are to be avoided in parenchymatous nephritis, one may substitute for them a salt rub followed by a short, hot douche, which has a stimulating effect.

Prescription.—Light bath, seven to twelve minutes. Salt rub.
Circular douche at 105° F. (40.4° C.), thirty seconds, 15 pounds.
Jet and fan douche at 105° F. (40.4° C.), thirty seconds, 15 pounds.
Dry rub. Rest thirty minutes.
Repeat three times weekly.

Cold Applications.—It is no doubt possible to apply altogether too energetic procedures in nephritis and hence produce harm. For this reason, cold baths and douches have not been used by the author, although strongly advocated by some hydrotherapeutists. von Noorden opposes the prejudice against cold water and strongly advocates the cold rub (*kalte abreibung*), followed by strong friction to produce reaction. In this he is supported by Dr. Baruch.

The late Dr. G. W. Foster, of the Eastern Maine Insane Hospital, used cold applications with success in the renal complications of acute delirious mania. The patients had a marked reduction in the amount of urine and of urea with albumin and casts. He applied cold wet packs over the loins and abdomen, and also general cold packs and full baths at 70° F. (21.1° C.). These packs were applied continuously and were renewed three or four times daily. Foster held that renal engorgement of the active or passive type does not contraindicate the use of tub-baths at 70° F. (21.1° C.) if they are not unduly prolonged. His general packs were given with water at 70° F. (21.1° C.) for one and one-half hours' duration. It was the excellent reaction occurring in the pack that accomplished the result, and he claimed that no

diuretic, within the limits of his experience, was at once so effectual, safe, and generally applicable as the local packs.

Amount of Urine.—It is a common experience to note an increased amount of urine after various hydrotherapeutic measures. This is more evident after cold applications than after warm ones. Cold wet packs applied over the loins and abdomen or tub-baths at 70° F. (21.1° C.) or below will almost always increase the flow of urine. This may amount to double or more than triple the previous amount voided. In using the Brand bath in typhoid fever the increase of urine is commonly noted, and much of the benefit derived therefrom is due to the increased elimination of toxic matter in this way. (See p. 45.)

TOXEMIA OF PREGNANCY

This condition is liable to result in eclampsia if unrecognized and untreated. It is most frequent between the thirtieth and thirty-fourth weeks of pregnancy. In mild cases the skin should be stimulated by simple warm baths, given in connection with enemata and lavage by normal salt solution.

In severer cases hot packs are required until free perspiration results. As the urea is diminished, bathing and the internal use of abundant pure water are demanded.

UREMIA

In uremic cases and in eclampsia hot packs and vapor baths are demanded. One should not postpone venesection in order to give the hot pack. The hot wet pack and vapor bath are always useful; but if the patient be unconscious, great care must be taken to see that the skin is not scalded. Packs may be given for thirty minutes every four hours. In the excitement attending these cases accidents have happened in the lying-in room.

Hot bricks wrapped in flannel soaked in hot water or hot bottles are commonly used to convey moist heat. A country practitioner told the author that he had used successfully hot ears of corn. Hot corn gives off a great deal of moisture and

retains its heat for a long time, especially when some of the enveloping husks are allowed to remain. (See p. 341.) Under ordinary circumstances the labor may be let alone while these measures are being instituted.

Baruch has observed in the nephritis of severe eclampsia a decidedly favorable change after a wet pack at 70° F. (21.1° C.) for one hour. (See Technic, p. 341.) He has demonstrated to his clinical students that after such a cold wet pack the sheet is taken away warmer; while after a hot pack the blanket is found cool. The reason is simple: the reaction during a cold pack fills the cutaneous vessels with warm blood and thus warms the skin, which in turn warms the sheet; while the hot blanket or sheet gives off its heat to the skin, thus cooling it. The symptom tension is relieved by the latter, and excretion is favored or rendered more normal by the former.

SCARLATINAL NEPHRITIS

Water is the best safeguard in this disease. Lime-water or Vichy should be added to the milk of young children, and aërated distilled water, Poland Healing Springs, Celestin Vichy, Ballard-vale, or other alkaline water should be administered very freely to older children and adults. Freely used, it dilutes the toxins and diminishes the acidity, thereby lessening kidney irritation. By stimulating catharsis and diaphoresis the elimination of toxins is facilitated.

For treating this condition, full tub-baths at 5 or 10 degrees below the body temperature, with the child enveloped in a blanket, give the best results, as such baths provide an equal distribution of the water. For infants and young children the bath should be warm—100° to 101° F. (37.8°–43.3° C.).¹

DIABETES MELLITUS

The well-known tendency of this disease toward infections of the skin and even to such serious complications as gangrene

¹ See article by Lowenburg, Jour. Amer. Med. Assoc., Feb. 17, 1906; see also p. 80.

renders it highly important to preserve the cleanliness and integrity of the skin. Aside from the usual daily cleansing bath of warm water with soap, it is desirable to educate the patient to the use of cold-water sponges, plunge baths, and douches, so as to increase the tone of the skin and of the nervous system, and, at the same time, to improve the general and, especially, the peripheral circulation. In advanced cases the best plan is to institute these measures at home and not to advise distant spas. The continuous or hammock bath at 95° F. (35° C.) for half an hour or longer, repeated twice a day, is advised in case the skin shows any serious feature. Hydrotherapy is an aid to dietetic management.

The following prescription may be given in moderate cases:

Electric-light bath, five to ten minutes.

Circular douche, 105° F. (40.5° C.), thirty seconds.

Circular douche, 90° F. (32.2° C.), thirty seconds.

Jet and fan douche to entire body at 70° F. (21.1° C.), twenty seconds.

Repeat daily, gradually increasing pressure of jet douche and lowering terminal temperature until 20 pounds and 60° F. (15.5° C.) are reached.

In the case of patients in which the disease is not far advanced, the beneficial effects of mountain spas at moderate altitude and conveniently reached are well recognized.

Drinking Cure.—While baths are not curative in diabetes, some features of the disease are modified by hydrotherapy, especially when waters are also used internally. At most spas this is the case, and the accessories of agreeable surroundings, different air, food, and occupation improve wonderfully the morale of diabetics and work a corresponding improvement in their physical states. At Carlsbad, Marienbad, Ems, Royat, Vichy, Neuenahr, and Mont-Dore diabetic patients are treated with more or less success by the combined method. These thermal waters favorably affect the skin, which is frequently very dry, and for the obese cases warm baths are a distinct advantage. Baths in the iron waters of Schwalbach, Spa, Pyrmont, and Franzensbad, and ferruginous peat-baths are commonly used abroad, but, as it has elsewhere been shown, these waters have

no special virtues by reason of their iron content. Their use internally, as is also the case with alkaline carbonated waters, is of considerable value. Consequently, the drinking cure is the more important.

Sea-bathing is permissible when the patient is robust and reacts well and when anemia is not marked. It is not strongly indicated in obese cases.

The Turkish bath is contraindicated.

DIABETES INSIPIDUS

In diabetes insipidus, douches, warm or cold baths, packs, and half-baths are advised. Forchheimer recommends the half-bath in all nervous children having diabetes insipidus. Baruch advises neurovascular training, as in neurasthenia.

As in diabetes mellitus, Turkish baths are contraindicated.

PHOSPHATURIA

This is commonly met with in cases of neurasthenia and is usually relieved or cured by the hydrotherapeutic methods employed in that affection. Among these are the half-bath with friction and affusions, rain baths or the descending douche, cold wet packs, and steam or electric-light baths, followed by circular and jet douches. Sea-bathing and the attendant exercises available at seaside resorts are very beneficial in phosphaturia. Exercise favors the return of the natural acid to the stomach and secretions. Mountain spas are well suited for such cases. (See p. 162.)

RHEUMATISM

CHRONIC RHEUMATISM

Chronic rheumatism is essentially a fibrosis or an inflammatory hyperplasia of the fibrous tissue of the muscles, joints, and ligaments. It is brought about by exposure to cold, damp and wet weather, sudden changes of temperature from hot to cold; or an attack may date from predisposing causes, such as injuries to limbs. An acute traumatic arthritis may eventually

become a "rheumatic" joint. Irritating toxins from the intestinal tract or from an acute gonorrhea may result in a so-called general acute articular rheumatism due to their specific poisons.

The value of thermal springs in the treatment of chronic articular rheumatism and the arthrites is recognized the world over. The chief factors are the systematic application of heat, the manipulation practised in the baths, and the consequent improvement of the circulation in the parts affected.

The patient for whom such treatment is deemed suitable is placed in a full bath at 102° to 104° F. (38.9° - 40° C.), with his head wrapped in a turban wet in cold water. An attendant rubs the limbs and the body while the patient is in the bath, applying movements graded in force to the affected joints. In patients accustomed to hot bathing, it is possible to begin with a temperature of 104° F. (40° C.), which, in most cases, is quite agreeable. After eight or ten minutes of the full bath the patient is dried and laid on a couch, where he is closely packed in a hot dry sheet and enclosed in three or four blankets. Here he remains for eight, ten, or twelve minutes, after which he is rubbed vigorously for five minutes with alcohol. On the fourth day the bath may be omitted and afterward the baths may include a preliminary hot douche at 103° or 104° F. (39.3° or 40° C.), applied all over the body excepting the head, the anterior chest, and the abdomen. The elements of this bath are naturally adjusted in time and in force to the needs of the patient as may be determined by his medical adviser. Cool sponging or a cold douche is frequently employed after the pack. General massage is also employed in suitable cases, sometimes during the day, but not usually directly after the bath, as after the bath the patient should rest quietly for an hour.

The rationale of this method lies in the better circulation established around the joints and in the increased mobility of all the tissues involved. Exudates in the fibrous investments of joints, in the sheaths of tendons, and in the muscular tissue create more or less disability, and, if untreated by external agencies, tend to increase pain and stiffness if not toward fixation of the limb. In

the case of spinal arthritis, even more serious fixation and deformity are likely to ensue, and hence the usefulness of general physiologic measures like hydrotherapy and massage.

In a systematic course of bathing the secret of success lies in a judicious education of the patient to bear heat and manipulation in an increasing gradation. Mild measures at the outset induce confidence and make possible later a degree of manipulation, depending upon the special characteristics of the case in hand, that would not otherwise be secured.

After a full bath in warm or moderately hot water, *e. g.*, at 104° F. (40° C.), followed by a hot dry pack, there is relaxation with sweating. A subsequent alcohol rub is then refreshing and produces a tonic effect. This is the main feature of the treatment at the Virginia Hot Springs.

It is well-known that when limbs are immersed in water less pain is elicited on active or passive movements than when the same movements are practised in the usual atmospheric medium. This fact is taken advantage of in these cases to the fullest extent, constituting one of the advantages of the full bath. In the bath the action of the skin is made better by the friction, which should always be insisted on, it becoming more pliable and free from all excretory matter. Both the superficial and the deep blood-vessels of the part, too, are enabled to take up and carry off any exudates or infiltrates, and thus relieve the restrictive influences on the motion of the structures involved, and the impairment of a proper interchange of circulation. Therefore, we adopt every means calculated to improve nutrition.

Secondary muscular atrophy, which is commonly observed in chronic joint disease, may be forestalled if treatment be started early and massage judiciously used in connection with hydrotherapy.

Painful Reaction.—After three or four baths there is usually a febrile painful reaction in the affected parts. This return of tenderness and swelling is discouraging to the patient. He should be warned in advance of it, and should be comforted

by the thought that it is a favorable indication of the ultimate relief to be derived from the methods employed.

The Uric-acid Fetich.—This still lingers with us and will probably remain for many years a valuable asset of many a mineral spring and patent medicine factory. As Dr. Arthur P. Luff of England says: "It has become of late years a fashionable craze to attribute many of these forms of 'chronic rheumatism' to uric acid. Most emphatically do I declare that it has neither part nor parcel in the production of any of these forms of fibrositis. I believe that uric acid possesses no toxic properties whatever, and I take this opportunity of most earnestly raising my voice against the absurd modern fetishism of this nitrogenous by-product, and of protesting against the shameful exploitation of it as a dangerous poison which too frequently disgraces the advertisement columns of our daily, weekly, and monthly papers."

ACUTE RHEUMATISM

In acute rheumatism, douches, affusions, and local and full baths may be employed if the patient be not wholly disabled. Most cases of acute rheumatism, however, are made worse by motion, so that it is usually a case of *noli me tangere*. If cold water in any form be used, however, it should be accompanied by vigorous friction. The body may first be sponged with water at 104° to 108° F. (40°–42.2° C.) for three minutes, followed with a vigorous rubbing with cold water at 70° to 60° F. (21.1°–15.6° C.) (Cohen).

The intense pain on motion, the fever, and the high pulse-rate generally observed constitute counterindications for tub-baths. If the pulse-rate in the recumbent position be above 90, the patient should not leave his bed. When the pulse is lowered to 80, tub-baths may be instituted. It is best in cases in which the heart is affected to begin with a half-bath at a temperature of 98° F. (36.7° C.) two or three times a week, and then increase their frequency as may be indicated. Cardiac complications render the use of greater heat than 98° F. (36.7° C.) unsafe.

CEREBRAL FORM OF RHEUMATISM

Cold Baths.—In the hyperpyrexia of acute rheumatism, in cases of the cerebral type, where the temperature suddenly rises from 102° or 103° F. (38.9° or 39.4° C.) to 105° F. (40.6° C.), cold baths should be employed at once. The water having an initial temperature of 85° to 90° F. (29.4°–32.2° C.) is gradually lowered to 65° or 60° F. (18.3° or 15.6° C.). If the patient be unconscious, he should be placed in water at 65° F. (18.3° C.) without delay, the duration of the bath being governed by the fall of temperature to 101° or 100° F. (38.3° or 37.8° C.). It will probably fall from 1 to 3 degrees more after removal from the bath. In the first bath a longer time is usually required to effect the same amount of temperature reduction than in subsequent baths—perhaps a half-hour or more. When removed from the bath the patient is dried and some stimulant given. If necessary, the baths may be repeated, but sometimes one will suffice.

The cerebral form of rheumatism is so serious in itself that there are practically no counterindications. The Clinical Society of London, through a Committee, has reported that only 1 case recovered among those observed having a temperature higher than 106° F. (41.1° C.) in which the bath was not employed; while of the bathed cases with a temperature of over 106° F. (41.1° C.) nearly 60 per cent. recovered. Several cases are on record in which the temperature reached 110° F. (43.4° C.) and in which recovery has followed the use of the bath; in some cases twenty-six baths have been employed.¹

These baths not only reduce the temperature, but they quiet the delirium; if comatose, the mind becomes clear, the pulse is reduced in frequency, and normal sleep returns to relieve the nervous system. When baths for any reason cannot be used, the patient should be sponged with ice-cold water or the cold wet sheet pack should be employed; or he should be

¹ See James Stewart, American Text-book of Applied Therapeutics, p. 535, W. B. Saunders Company.

placed on a cot protected with rubber and doused with water from a large sponge.

Cabinet Baths and Douches.—Although the method previously described¹ is the one usually adopted by the author, another method may be chosen and will give excellent results. Patients who have had the baths and packs for a time may be given a short series of cabinet baths and douches. The prescription would read as follows:

Hot-air bath or electric-light bath at 150° to 160° F. (65.6° – 71.1° C.), ten to twenty minutes.

Circular douche at 90° F. (32.2° C.), one minute, 20 pounds.

Scotch douche at 110° F. (43.4° C.) and 60° F. (15.6° C.), twenty seconds, 20 pounds.

Massage for the affected joints and muscles, fifteen minutes.

It may be desirable to start treatment with less contrast between the maximum and minimum of the Scotch douche, and in the course of four or five baths reach the temperature indicated in the prescription. If a greater contrast be desired, live steam may be employed in the Scotch douche. A rapid alternation of steam and cold water produces a profound local effect, and when the variation in temperature is so great, as in this case, the Scotch douche can be shortened to ten or fifteen seconds. The douche apparatus ordinarily in use is not provided with means for employing steam, but this forms a valuable accessory. The Scotch douche exerts a strong mechanical and thermal stimulus, and promotes the absorption of exudates in and about the joints and muscles. A combination of douches of two different pressures with simultaneous massage, as practised at Aixles-Bains, is very useful. So also the fixed douche, delivering water at 102° to 104° F. (39.9° – 40° C.) for eight or ten minutes at 15 to 18 pounds' pressure, may be made use of preliminary to the full bath and pack.

Fomentations are useful in muscular rheumatism. The affected parts are well lubricated with petroleum so as to reduce the danger of scalding the patient, and compresses, well

¹ See p. 121.

wrung out of hot water at about 140° to 150° F. (60° - 65.6° C.), should be applied. Compresses lose heat so quickly that the actual temperature of application is much less, and by making cautious attempts to place them, a fairly high degree of heat can be borne. After the fomentations have been applied and reapplied for ten, fifteen, or twenty minutes, the patient is washed off with water at 70° F. (21.1° C.), with friction, and dried. The addition of magnesium sulphate will enhance the value of the compresses (see p. 220). After this treatment the patient should rest for an hour on a bed or lounge.

PROPHYLAXIS OF RHEUMATISM

Hydrotherapy has a place in the prevention of rheumatism. In the case of children believed to be rheumatically predisposed it would be proper to adopt a careful and systematic method of accustoming the child to cool water. Cool salt-water baths followed by vigorous friction are of value in this respect, in that they improve the resistance and reaction of the vasomotor system. These baths can be cultivated as any other physical power. Vasomotor paralysis, with its tendency to the formation of toxins, should be met with appropriate exercises, cool baths, and frictions; electric-light baths and general thermic stimulation. Sea-bathing is usually attended with too much exposure and risk for children predisposed to rheumatism.

RHEUMATIC ENDOCARDITIS

In cases complicated with endocarditis, with a weak heart and a feeble, irregular pulse, hot fomentations should be employed locally over the heart. They will be found more stimulating than ice-bags or cold compresses. (See chapter on Diseases of the Heart, p. 132.)

ACUTE ARTHRITIC OUTBREAKS

The acute arthritic outbreaks which so often follow spa treatment depend upon the thermal action of the mineral baths. Similar attacks follow the use of plain hot-water baths devoid

of mineral properties. Garrod has seen a severe attack of gout brought on by taking a hot bath soon after dinner. Hot-air baths in cases of suppressed gout may determine an acute attack. These acute phenomena are usually interpreted as preparing the way for the elimination of uratic deposits. Though painful, the ultimate result is beneficial; the absence of any reaction in a case of gout after the adoption of thermal baths does not augur well for the benefits to be derived from the treatment.¹ Warnings should be given the patient of the likelihood of acute symptoms supervening.

Dr. H. C. Wood says that he has frequently seen an acute attack of gout precipitated by the application of heat to a long diseased joint about which there was much exudation. This acute attack has often been accompanied by a very perceptible lessening of the exudate, and Dr. Wood states his belief that such attacks are due to the absorption into the blood of gouty acids or salts which had been liberated from tissues of the joint. Undoubtedly the chemic movements of diseased joints or exudates in other localities are increased by the application of heat. The use of heat is of great value in the treatment of local inflammatory conditions with exudation, whether rheumatic or not. In these cases fomentations may afford relief.

GOUP (ARTHRITIS URICA)

In all probability gout consists in a defect of metabolism whereby products derived from cell nuclei are not properly used up or excreted. These products may arise either from nuclear matter contained in the food or from the natural wear and tear of tissue-nuclei; they are retained in the system, and a deposit of one of them—sodium biurate—in the joints sets up irritation there and causes an acute attack of arthritis.

We must not be blind to the fact that in using “that blessed word” metabolism, we mean no more than the chemical side of life itself. All diseases are disorders of metabolism—in other

¹ Francis Hare, M. D., Medical Record, June 17, 1905.

words, perverted vital activity. Hence we practically come back to our original starting point—that gout is a disease which we do not understand.¹

The hydrotherapy of gout follows very much the same lines as that of rheumatism. It is a protean disease capable of manifestations from the head to the toe, and, in its acute stages, a formidable affection.

Gouty affections respond favorably to hydrotherapeutic and dietetic treatment; indeed, patients of this class constitute a very large proportion of the clientele of spas. Such patients, perhaps more than any other, recognize the importance of repeated preventive measures and frequently make a practice of taking the cure afforded at famous resorts in Europe and America.

Choice of Spas.—An attempt has been made to differentiate the various European spas in the treatment of gout, largely on the basis of the associated use of waters internally² (see pp. 404 and 410).

The methods employed vary considerably at these spas and the waters themselves vary widely in their constituents, embracing those of indifferent character, such as Teplitz, Warmbrunn, and Plombières; the sulphur waters of Aix-la-Chapelle, Baden in Austria, Baden in Switzerland, Bareges, and Cauterets; or the brines of Nauheim, Kissingen, and Soden. In general, the distinction is made that when local effusions remain after repeated attacks of gout, thermal baths of high temperature are indicated. These are employed for all local gouty affections as well for their paralytic and neuralgic sequelæ.

In cases of great debility the baths given at Gastein, Pfaefers-Ragatz, Wildbad, and Loèche-les-bains are suitable. When there are large gouty nodules, contractures, ankyloses, and disorders due to effusions, local and general peat and mud-baths are used.

The sulphur waters are chosen when skin affections or syph-

¹ Editorial, *Medical News*, July 23, 1903.

² See Prof. E. Heinrich Kisch, of Prague and Marienbad, in *A System of Physiologic Therapeutics*, vol. ix, p. 464.

ilitic diseases coexist. When the heart is impaired and general enfeeblement marks the case, the saline baths and carbonated baths of Nauheim, Rehne, Kissingen, and Soden are prescribed.

In England the baths of Buxton are largely used for gout. The Buxton undercurrent or indirect douche described on p. 277 affords an excellent combination of a partial immersion warm bath with a douche of somewhat higher temperature, 98° to 104° F. (36.7–40° C.), and a moderate pressure of 15 pounds to the square inch from a small-caliber nozzle. The famous Aix douche, comprising two calibers and two pressures administered by two attendants, is used without the immersion bath, but accompanied by general and local massage (see p. 263).

At the Virginia Hot Springs use is made of a fixed descending jet douche delivering water at 104° F. (40° C.) at a pressure of 14 to 18 pounds. This is commonly followed by a full bath at 100° to 104° F. (37.8°–40° C.), with or without massage in the tub, and a subsequent dry blanket pack for ten to twenty minutes, terminating with a cool douche and a quick alcohol rub.

At Mt. Clemens, Michigan, and at Richfield Springs, Sharon and Clifton Springs, New York, sulphur baths and douches are employed. These sulphureted saline waters are usually employed at somewhat lower temperatures than at the Virginia Hot Springs, and, the waters being of a naturally lower temperature, are necessarily artificially heated to the required degree.

There is scarcely a spring or inland spa in Europe or America where the treatment of gout and rheumatism by hydrotherapeutic measures may not be carried out. If the publications emanating from these resorts, usually accompanied by a wealth of testimony as to cures in this class of diseases, are to be believed, it must be admitted that gout and rheumatism are cured by baths in waters of most diverse chemic analysis; by baths of every type; by douches, packs, mud, peat, and fango, not to speak of drinking-waters of every description.

This leads us to deny any essential difference in hydrotherapy as distinguished from balneology; they are but parts of one great system of physical therapy. The attempt to differentiate the

relative value of various mineral waters or even of various hydrotherapeutic methods in relation to the protean forms of gout and rheumatism is a relic of the time-honored search for specific remedies in given forms of disease. The modern medical world is gradually giving up this pursuit of the golden fleece in therapeutics and is turning to the more rational effort to make use of general measures based on physiologic processes, relegating to the background the non-essential features once so highly prized.

The prime factors in all modern hydrotherapy are moisture, heat, pressure, and manipulation. These are the four corners of the temple of hydrotherapy.

GONORRHEAL ARTHRITIS

Gonorrhreal rheumatism, so called, or gonorrhreal arthritis may be treated in the same manner as other forms of rheumatism or arthritis; namely, by warm or hot baths, douches of warm or hot water, not over 104° F. (40° C.), and the subsequent use of hot dry packs. At Buxton the practice is to use the undercurrent douche to the affected joints. If synovitis be present, the joints are kept at rest. Plenty of good nourishing food and iron are used. Under this method of treatment the periosteal thickenings quickly disappear.¹ (See p. 277.)

The object of treatment is to promote absorption of inflammatory products. These are found in the synovial sheaths, bursæ, and tendons. They need the stimulation of heat and moisture, but do not require much, if any, manipulation, unless in the more advanced or chronic stage. Fomentations may greatly relieve the pains of the more acute cases.

In dealing with advanced cases we may use more stimulus in the form of jets of higher pressure, the Scotch douche with its variations of temperature and the Aix douche, or other revulsive measures. In any case care must be exercised to avoid bringing on active inflammation by vigorous attempts at passive motion or by too severe massage.

¹ Personal communication from Dr. John Braithwaite, Buxton.

In the later stages of gonorrhreal arthritis, benefit may be derived from very hot mud-baths. The general plan of treating gonorrhreal arthritis is similar to that of ordinary articular rheumatism, at least as far as hydrotherapy is concerned; but the writer has found the endocarditis of gonorrhreal cases a serious complication and one that demands watching and very judicious management.

ARTHRITIS DEFORMANS

This is probably an infectious trophoneurosis.

In order to bring about absorption of the exudates and restore motion to the affected joints, it is a common practice in Europe to employ hot-air baths, compresses of fango, moor baths or packs, hot wet packs, hot-sand baths, or electric-light baths. After these applications there is an increased sweat production followed by a moderation of the symptoms, together with reduction of the swelling and increased mobility of the joints. When the disease has progressed so far as to have produced hyperplasia with deformity, the prognosis is unfavorable, no matter what means are employed. Amelioration may follow hydrotherapy, though cure may be impossible. Hot sulphur saline baths have given some good results.

Most observers agree that ordinary hot baths in arthritis deformans are not to be recommended or, at least, are to be employed only in the early stages. When ordinary baths are not employed it is better to use the Bier passive congestion treatment (compression by rubber bandage above the joint) or baking with hot dry sand or hot air. The writer uses the hot-air cabinet followed by circular, jet, Scotch, and fan douche. The type of bath employed must be determined after study of the individual case. After the bath the patient should walk in the open air.

Dr. Wood states that the effects of heat are much more prompt and marked in cases of small than of large joints. The latter are not raised to that degree of heat possible with smaller joints, and for this reason better results are obtained in treating an ankle than a knee.

The use of heat in rheumatic cases should not be relied upon exclusively, but rather as an aid to general treatment. When so used, the action of the skin must be increased by warm douches and tub-baths (see p. 121) and the patient well wrapped in blankets.

DISEASES OF THE HEART

No hydrotherapeutic measure of a general character for medical purposes should be used without competent advice. This presupposes some knowledge of the heart and circulation and ought to include some estimation of the blood-pressure. It is remarkable how many persons are perfectly willing, and sometimes quite insistent, in their desire to take hot baths, douches, and packs without any competent medical advice, relying entirely on the bathing attendant or previous experience. Anyone who has practised at a spa is familiar with this type. Men who would not for a moment think of managing their own legal affairs, will not hesitate to subject their bodies to all sorts of circulatory gymnastics. Whether the results are good, bad, or indifferent is probably their own affair, but it is the duty of those in charge of spas to insist on preliminary medical advice. There is probably no public resort in the United States where this is strictly required. Those under private management endeavor to give treatment only on a physician's prescription, and this undoubtedly furnishes some safeguard against much disappointment or serious accident. Sudden death in the bath or within a few hours afterward is occasionally reported in the daily press and may happen at the best regulated spas. Deaths from heart disease and apoplexy are most to be feared and cannot always be foreseen. The class of patients coming to mineral spas includes those who have persistently overworked their brains, overfilled their stomachs, overstimulated their hearts, and indulged in all sorts of excesses, so that the problem of restoring them to normal condition is one of the greatest in medicine. Many recognize the value of hydrotherapy and return to their favorite spas once or twice a

year "to take the cure," and thus live on, more or less restored for future work or indulgences as the case may be.

The most famous spa in the world for cardiac affections is, undoubtedly, Nauheim. Its popularity is evidenced by the fact that over 30,000 people visit this resort annually.¹ How many of these thousands of people are carefully studied and frequently observed cannot be said, but in the rush of "the season" many undoubtedly receive the most superficial medical treatment. At Carlsbad and Honiburg in the fashionable season the conditions are probably no better, and this notwithstanding that experience has taught that the best results follow strict medical supervision by a physician who can follow his patient throughout his course and occasionally see him in or just out of his bath. In no other way can the patient be properly guided.

Effects of Baths in Cardiovascular Disease.—There is a notable discrepancy of opinion as to the effects of baths in cardiovascular disease. The effect of hot and cold douches on the blood-pressure has already been described (see p. 48), and reference has already been made to the use of the sphygmomanometer and the sphygmograph and to the effect of hot and cold applications on the rate of the heart. In the chapter on the Nauheim Baths reference is made to their use in cardiac disease (see p. 310), and the effects of baths in cases of arteriosclerosis are referred to on p. 147.

Danger may be less apprehended in cases of aortic and mitral insufficiency than in endocarditis, myocarditis, and arterial degeneration; less, also, from cool baths and douches than from hot baths and packs. It is noteworthy that the Nauheim bath, so beneficial in cases of cardiac dilatation, ranges considerably below the body heat. Starting at 95° F. (35° C.), it is lowered in successive baths to 90° or 85° F. (32.2° or 29.5° C.). Simply because a patient has a double murmur it does not follow that hot-air cabinet baths reaching 150° to 160° F. (65.6°–71.1° C.), and followed by needle, jet, and Scotch douches should not be used. The author has used such baths in cases of this type with

¹ The baths given in 1907 numbered 419,277.

benefit and is most cautious in the presence of arterial degeneration with high blood-pressure. Hot as well as cold baths raise the arterial pressure, and hence these measures should be used only for short periods, if at all, with both elements of heat and cold properly arranged and apportioned. In this way the general circulation is improved and the nervous system refreshed without allowing either heat or cold to make too positive or too prolonged an impression. For cases of this type it is much safer and better to use the cold pack at night preceded and followed by friction. Electric-light baths are also beneficial.

The Turkish bath is especially liable to be abused, inasmuch as it is generally taken on the bather's own initiative. Its restorative powers after excessive drinking or prolonged debauch are well known; but there comes a time, especially in these cases, when the arteries fail to withstand the strain and serious accidents are liable to ensue. Cases of arteriosclerosis, in which the cardiac valves may be sound but the heart muscle degenerated, are dangerous subjects for the Turkish bath. For all such cases the bath should not be more than tepid, 90° to 95° or 98° (32.2° – 35° or 36.7° C.), and preferably prepared more or less after the manner of the Nauheim bath, with sodium and calcium chlorid and possibly with carbonic acid gas. Here, again, caution is necessary, for the effervescent Nauheim bath raises the blood-pressure slightly for a few hours. (See p. 429.)

NAUHEIM BATHS AND SCHOTT TREATMENT

Any discussion of the treatment given at Nauheim for cardiac disease naturally includes the graduated exercises known as the *Schott resistance exercises*. Herein lies much of the advantage to be derived from a visit to Nauheim, where these exercises are skilfully practised. The tendency outside of Nauheim is to attribute the chief influence to the baths, and this belief is shared by a good many physicians at Nauheim.¹

Trained assistants competent to give these exercises are now

¹ See Jour. Amer. Med. Assoc., March 10, 1906, p. 714.

found in the larger cities of Europe and America, and from the combined methods a great deal can be accomplished outside of Nauheim. A full description of these exercises has been published by Satterthwaite,¹ Kinnicutt,² Schott,³ Martin Siegfried, A. Abrams, Victor Neesen, W. C. Rives, J. M. Anders,⁴ J. Howe Adams, David Bovaird, Jr.,⁵ Douglas Graham, G. W. Norris, and others.

The accompanying illustrations are Satterthwaite's; they speak for themselves as to the variety and character of the exercises, to the greatest importance of which there is a growing tendency toward appreciation. (See Figs. 25-39.)

These **exercises** consist of slowly conducted flexion, extension, adduction, abduction, and rotation, in orderly succession, of the trunk, arms, and lower extremities. Each succeeding movement is resisted by the attendant with such force as to oppose without arresting it. Each movement is slowly and evenly made with a definite and uniform effort on the part of the patient. The attendant not merely resists the movement, but in addition he imposes a short interval of rest after each movement, enjoins slow and regular breathing, and prevents any undue strain, such as would be shown by hurried respiration. He also bears upon but does not grasp or constrict the limbs. Kinnicutt points out these requirements quite fully, showing that the degree of resistance and number of movements should be modified or discontinued according as they affect the pulse and respiration.

The duration of a single treatment is, as a rule, fifteen to thirty minutes. In Satterthwaite's scheme they range from twenty-eight to thirty-seven minutes, including the intervals of rest. In gentle exercise the pulse is lessened three or four beats and there is a rise of blood-pressure. Later the pressure falls to normal and the pulse is frequently unaltered.

¹ Thomas E. Satterthwaite, International Clinics, vol. i, 13th series.

² F. P. Kinnicutt, Boston Med. and Surg. Jour., May 17, 1906.

³ Theodor Schott, Boston Med. and Surg. Jour., May 16, 1907; Medical Record, March 26, 1898; N. Y. Med. Jour., May 11, 1907.

⁴ Jour. Amer. Med. Assoc., Jan. 14, 1905, p. 116.

⁵ Medical Times, March, 1909.



Fig. 25.—Chest raising.



Fig. 26.—Shoulder raising.

Fig. 27.—Forearm flexion and exten-
sionFig. 28.—Leg and thigh flexion and exten-
sion—extension.

Operator indicated by an X.

(Figs. 25-39 are from Satterthwaite's article in International Clinics.)



Fig. 29.—Leg and thigh flexion and extension—flexion.



Fig. 30.—Thigh flexion and extension.



Fig. 31.—Trunk flexion.



Fig. 32.—Trunk extension.

Operator indicated by an X.



Fig. 33.—Leg abduction.



Fig. 34.—Leg adduction.



Fig. 35.—Trunk rotation.



Fig. 36.—Arm separation.

Operator indicated by an X.



Fig. 37.—Arm opposition.



Fig. 38.—Quarter circling.



Fig. 39.—Trunk flexion laterally.
Operator indicated by an X.

"The effects of the baths and the Schott exercises are a shrinkage in the area of cardiac dulness and a slight upward movement of the apex. An exact radiographic study shows that this means a lessening of the volume of the heart. The duration of this diminution in size is very short, but the continued employment of the method produces permanent results. The best results are obtained in cases of enfeebled, relaxed, dilated hearts, with or without a murmur, following prolonged and exhausting diseases. It is also useful in cardiac inadequacy which follows severe muscular effort. In incurable organic disease the best results are obtained in mitral insufficiency with dilatation. Where the compensation is maintained with difficulty and in the early stages of failure very striking results are secured.

"The Nauheim treatment is sometimes useful in cases of *angina pectoris*. In those in which the disease is due to organic coronary disease, the prospects are not so good. Cases with a high vascular pressure, those above 170, should not be subjected to this treatment. In administering the treatment little exertion and no fatigue should be the watchword. Much depends upon a careful selection and instruction of the operator. There is a tendency on the part of the patient to hold the breath and keep the body rigid, which involves greater conscious effort. This must be avoided. The operator should be trained in the observation of ordinary symptoms. The use of too great resistance is the most common fault of the operator and the most difficult to correct. The resistance exercises alone are often useful in cardiac inadequacy" (Kinnicutt).

In all cases particular care must be exercised to adapt the baths to the individual needs. The process must be mild at the outset; weak hearts are never suitable for strong baths and the congestion-dilatation of the heart has been observed by Pratt and others, as well as the author, to be distinctly increased by the bath. If there is a fall in the blood-pressure after the bath given at a temperature of 87° to 92° F. (30.5° - 33.3° C.) it indicates that the heart is weak and the bath too strong. Dr. Pratt usually begins the treatment with a bath one-fifth or three-

RECORD OF A CASE OF SLIGHT CARDIAC INSUFFICIENCY (MR. B. E. B.)

(PATIENT OF DR. J. H. PRATT, BOSTON)

Before CO ₂ Baths.				After CO ₂ Baths.			
1908.	Blood- pres- sure.	Pulse.	HCl. cc.	Na ₂ CO ₃ Gm.	Dura- tion, Min.	Blood- pulse,. pressure.	Remarks,
Oct. 7	64	105	91 400	800 10	66 115	Dry rub, rest twenty-five minutes.....	171 $\frac{1}{2}$
9	64	105	90 500	1000 11	72 115	Dry rub, rest twenty-five minutes.	
12	64	110	89 600	1200 12	64 125	Dry rub, rest twenty-five minutes.	
15	72	105	88 700	1400 13	76 115	Dry rub, rest twenty-five minutes.....	172
17	68	105	87 800	1600 14	72 110	Dry rub, rest twenty-five minutes.	
27	68	120	86 900	1800 15	72 145	Dry rub, rest twenty-five minutes.	
Nov. 31	72	150	85 900	1800 16	72 150	Dry rub, rest twenty-five minutes.....	171 $\frac{1}{2}$
5	68	130	84 700	1400 13	60 146	Dry rub, rest twenty-five minutes.....	170
7	64	125	84 700	1400 13	44 145	Arc L. before bath ten min. Dry rub, rest one-half hour.	
14	60	125	87 800	1600 14	66 143	Arc L. before bath ten min. Dry rub, rest one-half hour..	170

Dr. Pratt has noted decided benefit from carbon dioxid baths in certain cases of cardiac insufficiency; they generally raise the blood-pressure and have produced in some cases a transitory reduction of cardiac dilatation. They are of undoubted value in the cardiac neuroses; but they are never followed by improvement, in his experience, when the heart muscle was markedly weakened.

tenths the full strength. At the Medical Baths in Boston the attendants take the blood-pressure before and after every carbon dioxid bath, and this furnishes a most useful guide.

It is well to remember that the "Nauheim treatment" and treatment at Nauheim are not convertible terms, and the reader is referred to a later chapter in which these various measures are more fully described.¹

Delimiting the Cardiac Area.—The most striking feature of the good influence of systematic resistant exercises and Nauheim baths on the heart is the contraction of the cardiac area. In a dilated or hypertrophied heart or in one that combines both dilatation and hypertrophy this recession may be recognized after the use of the exercises which are generally instituted for a time before the baths begin. During the period of bathing this rise of the apex-beat and contraction of area continues until the physical signs plainly show the improved tone of the cardiac muscle. It requires, however, a good deal of skill and experience to be able to map out accurately the area of cardiac dulness and make a proper record with which to compare future observations. Even the location of the apex-beat is often beset with difficulty; and as for the borders of the heart, their limitations are so masked by the pericardium, the thorax, the superficial fat, varying conditions of the stomach and of the lungs, not to mention the possibility of a mammary gland, that reports of the alteration by $\frac{1}{8}$ inch in successive observations have always seemed to the author beyond the power of human recognition, notwithstanding the orthodiograph and other means for delimiting the cardiac area. Nevertheless, in male subjects with thin chest-walls changes may be observed after a time by using a fixed method of observation.

Satterthwaite's Method of Delimiting the Cardiac Area.—The best and simplest plan is that used by Satterthwaite. He draws on the skin with the dermatographic pencil a horizontal line through the nipple and then a vertical line from the episternal notch to the umbilicus. He then traces out by percussion the

¹See pages 310 and 428.

outline of the heart and indicates the position of the apex with an **X**. He then applies tracing-paper to the chest and marks on it the horizontal and vertical lines, the outline of the heart, and the positions of the apex and nipples. At each examination a similar tracing is made, and in this way, by successive records, the changes are noted. Much will naturally depend on whether light or heavy percussion is adopted, and, therefore, an effort should be made to use the same amount of force in corresponding portions of the cardiac border.¹

To illustrate the method employed, the following is a record by Dr. Satterthwaite of a young woman who had cardiac hypertrophy, mitral regurgitation, and an irritable heart. She was slight in build and a neurotic subject, addicted to hysterical surprises, had morbid fears, pseudo-angina, insomnia, and gastric disturbance with constipation. On February 1 her apex was found in the fifth space, in the line of the nipple, $3\frac{1}{2}$ inches from the median line. At the apex a harsh and distinct systolic murmur was heard, carried to the left. At the base a soft systolic murmur was heard, confined to the aortic area. The heart sounds were feeble and the pulse intermittent. The urine was normal. After the preliminary rest and attention to her general condition, she was given a limited number of general movements, lasting fifteen minutes. These were given daily and gradually increased in number and force for five consecutive weeks. On February 8 the basic murmur was inaudible. The movements given on that date were twelve in number. February 11, nineteen movements, occupying half an hour. February 13, apex $3\frac{1}{4}$ inches from the median line; heart sounds somewhat stronger. February 16, 20 movements; pulse 96 to 84; respiration, 14. February 17, apex $3\frac{1}{4}$ inches from the median line. February 23, carbonated brine bath, with resistant exercises; apex $3\frac{1}{8}$ inches from the median line. March 1, apex 3 inches from the median line. Pulse before the baths, 92; immediately after, 80; later, 73. The patient is gaining

¹ See Thomas A. Claytor, Immediate Palpatory Percussion, Trans. American Climatological Assoc., vol. xxiv, 1908; also Moritz.

flesh. Menstrual flow is greater than for five or six months; there is no insomnia. She now had occasional attacks of pseudo-angina, but these were milder than previously and yielded to monobromate of camphor. Apex now $2\frac{1}{2}$ inches from the median line and $2\frac{1}{2}$ inches below the intermammary line.

On April 1 the apex was $1\frac{7}{8}$ inches from the median line and $1\frac{3}{4}$ inches below the intermamillary line. On May 21 the patient has had only one nervous attack during the past six weeks; she has slept well, and on June 4 was noted as still improving.

It will be noted that in this case there was a recession of $1\frac{5}{8}$ inches in the apex-beat, and had it not been for the careful and systematic records it would scarcely have been believed.

Dr. Bezley Thorne and Dr. Leslie Thorne Thorne use practically the same method, except that they use auscultatory percussion, employing a light stroke from a rubber-topped pencil, in which they are especially skilful.

Enlarged hearts with valvular lesions certainly yield to this treatment, and when dilated and associated with a neurosis the results are often surprising.

It is only fair to say that both in Nauheim and in America there is some doubt as to the possibility of reducing the size of a dilated or hypertrophied heart. It is only fair, perhaps, to hear the other side.

Dr. David Bovaird, Jr., of New York, in a review of the Nauheim treatment, has expressed great skepticism on these points, as given in a paper before the Academy of Medicine, New York, Nov. 17, 1908:

“Those who have read certain publications bearing upon the immediate change in size of the heart affected by these Nauheim baths, have been greatly impressed with the tracings shown indicating an immediate reduction in the size of the heart affected by a single bath. It can safely be said that there is doubt of the accuracy of such statements and that even after a long series of these baths in most cases little or no reduction in the size of the heart can be demonstrated by accurate scientific methods. Apart from these specific effects of the bath, patients regularly

find them physically very agreeable, a judgment which the writer can corroborate from personal experience. The effect of the treatment, as a whole, is to produce the first week or two a feeling of very marked lassitude, and weakness of which most of the patients keenly complain; but gradually the weakness and lassitude disappear and the patient becomes conscious of a steady improvement, which is usually very satisfactory."

Cases with edema or with renal or pulmonary complications are not deemed suitable for the Nauheim treatment.

"The baths given in the course of treatment are prescribed for each individual patient as the judgment of his physician determines. They vary in their composition as derived from one spring or another, or by the combination of the waters of two springs; in their temperature for like reasons, and in the time devoted to each bath. They are further modified by being given in what are known as half- and full-baths. In the half-bath the water rises only to the nipple line as the patient sits in the tub. In the full bath, to the level of the chin, the body being completely covered.

"The average cure consists in taking a series of from twenty-five to thirty baths, given in groups of two or three at a time, with a rest day between each group, and running in succession through the several grades of thermal, thermal-sprudel, and sprudel baths, the thermal being regarded as the mildest of the baths, the sprudel as the most effective. All of these baths have been used for many years and their effects noted, as they have been modified in the processes of a cure. We have really very little satisfactory information as to the nature of their action, and the manner of combining them appears to be determined by the experience of the individual physician" (Bovaird).

The author made a special effort to settle in his own mind the uncertainty which naturally arose in view of such conflicting statements. Dr. Bezley Thorne very clearly demonstrated to him, in his office in London in 1910, that by accurate auscultatory percussion and the preservation of tracings of the cardiac area so defined, a noteworthy reduction in the size of the dilated heart

actually occurs in the course of artificial Nauheim baths with their associated resistant movements. The most carefully made tracings in numerous cases convinced the author that Drs. Thorne, Dr. Satterthwaite, Dr. Kinnicutt, and others, who have reported such changes, are perfectly correct.

Probably a great help in recording the variations in the cardiac area will be found in the use of the orthodiagraph. This instrument has been used but very little as yet in the United States. One is in use in Washington, where Dr. T. A. Claytor has employed it, and several are used in the large hospitals in Continental Europe. The author saw one in the Polyclinic at Rome. It consists of a combination of fluoroscope and Röntgen tube. The fluoroscopic screen is provided with a pencil which moves synchronously with the Röntgen tube, so that the rays are always projected in parallel lines to the pencil point. A double arm holding the tube back of the patient and the pencil in front of a tablet on the chest enables one to make a perfect outline of the heart. Such an apparatus, when checked by a skilful auscultatory percussion, tends to eliminate somewhat of the personal equation in the rather difficult art of tracing the cardiac area. The instrument will no doubt be fully tested and its possibilities and limitations fully determined.¹

PERICARDITIS, ENDOCARDITIS, AND MYOCARDITIS

Heat uniformly accelerates the heart. Hot applications, therefore, may be expected to stimulate the failing heart, especially if its slow action be due to intoxication, exposure to cold, partial drowning, or other depressing cause. Cold, on the other hand, slows the rate of the heart, increases the arterial pressure, represses inflammation, improves the tone of the cardiac muscle, and relieves pain.

In pericarditis and endocarditis the local use of cold is of the

¹ See article by Schiffer and Weber on Percussion of Absolute Dulness and its Value in the Determination of the Size of the Heart, *Deutsch. Archiv. für Klin. Med.*, vol. xciv, No. 5.

highest importance. The ice-bags or Leiter coil should be kept on day and night, watching the skin to see that no ill effects result. In delicate subjects these may be avoided by interposing a little gauze between the ice-bag and the skin. In myocarditis the ice-bag should not be used unless there are distinct signs of inflammation. Neither should the resistant exercises practised in connection with the Nauheim treatment be adopted, as a rule, unless the myocardial element is of a minor character subsidiary to other cardiac conditions.

ARTERIOSCLEROSIS

In general, it may be said that the blood-pressure is lowered by warm applications in cases of arteriosclerosis, whereas cold applications in these cases raise the pressure.

In cases of nephritis, with arteriosclerosis and high blood-pressure, any extreme of heat or cold should be avoided. Baths of an indifferent temperature, *e. g.*, between 95° and 100° F. (35° and 37.8° C.), may be allowed; or Nauheim baths, ranging from 86° to 95° F. (30°–35° C.). (See pp. 48 and 310.) An estimate of the degree of arteriosclerosis and of the blood-pressure should be made by means of the sphygmograph and sphygmomanometer. (See pp. 49 and 52.)

Hot Baths for Arteriosclerosis.—Hirschfeld, noting that arteriosclerosis is the inherent penalty of strenuous life, meaning, of course, the overstrenuous life with excesses, advocates the systematic employment of hot baths, which have given him favorable results during the past two and a half years. The beneficial effect of the hot bath upon the patient suffering from arteriosclerosis is fourfold, as follows:

1. The distribution of blood-pressure is changed by the unloading of the internal organs and the increase of vascularization of the skin. Hence these changes afford relief in many of the various cases of pain associated with internal gout, which is so frequent a cause of arteriosclerosis. The sleeplessness which is so often troublesome in arteriosclerosis becomes in a short time manageable without drugs.

2. The hot bath increases combustion, which means increased metabolism, increased oxidation of waste products, and an increased respiratory exchange.

3. Elimination of waste products is increased.

4. Blood-pressure is reduced in the same manner in which the pressure of water running from one tap is lowered as soon as another tap is turned on. The patient is bled into the skin, and the pulse at once becomes faster and more frequent. The systematic employment of the hot bath at last establishes an increased vascular habit of the skin, thus permanently lowering blood-pressure.

The *oxygen bath*, lately introduced, is said to have a good effect by reducing the blood-pressure in arteriosclerosis. (See p. 323.)

TOXEMIC MYOCARDITIS

In toxemic myocarditis, whether from diphtheria, scarlet fever, typhoid fever, pneumonia, or other infection, it is highly necessary to supply artificial heat to the body by means of hot-water bags in connection with gentle massage. Hot normal saline colonic flushings at about 115° F. (46.1° C.) will often rouse a poor circulation; especially is this the case in the intestinal paresis that may accompany a pneumonia.

Another measure not to be neglected is the mustard foot-bath. A little mustard is placed in cheese-cloth and added to a foot-bath at 100° F. (37.8° C.) and the feet bathed for one minute. This may be repeated in an hour.

Murphy's method of proctoclysis, in which large quantities of water are slowly absorbed, is not at all suitable for cases complicated by pneumonia, and is positively dangerous in any advanced stage of that disease.

CHRONIC RHEUMATIC MYOSITIS; LUMBAGO

This condition is characterized by indurations due to some autotoxic metabolic disturbance and is amenable to treatment, not too violent, which favors restoration of good circulation.

Tepid baths and hot dry packs are indicated. Moderate rubbing during the bath may be employed, but any systematic or vigorous massage is liable to bring on acute painful conditions simulating rheumatism. When situated in the neck or shoulder, this form of inyositis is very troublesome, especially before the usual hour of waking. It wears off as the day advances and as voluntary motion favors a more vigorous circulation than during the period of rest.¹

ALCOHOLISM; MORPHINISM; CHRONIC LEAD-, MERCURY-, AND ARSENIC-POISONING, AND TOBACCO HABIT

This is one of the most favorable fields for hydrotherapy. In *acute* cases the Turkish bath yields, as a rule, immediate results. If this be not convenient, a prolonged soaking in the warm full bath at a temperature of 100° to 102° F. (37.8–39.9° C.), followed by friction and rest in bed may be employed.

Chronic alcoholism is best treated by the use of tub-baths at 102° to 104° F. (39.9°–40° C.) for ten, fifteen, or twenty minutes, followed by packs in hot blankets for similar periods. Cases demand treatment in accordance with the general physical condition. The corpulent, robust man may or may not have a good cardiac and circulatory system and the immediate effect of these procedures must be observed. If they are well-borne, these measures may be pushed to the higher limit and followed by cold sponging or cold douches. (For the neuritis resulting from abuse of alcohol see under "Neuritis.")

Measures similar to those employed in alcoholism may be adopted in chronic lead- and mercury-poisoning and morphin and tobacco habitues. Tonic measures and the use of the hot-air cabinet, followed by the circular douche, jet, Scotch, and fan douche, and an alcohol rub will be required where there is debility, and especially after a course of tubs and packs.

The **internal use of waters**, particularly those containing

¹ N. S. Yawger, *The Lancet*, July 31, 1909. See also Sir W. R. Gowers on Lumbago, *Brit. Med. Jour.*, Jan. 16, 1904, p. 117.

magnesium sulphate, aids in the treatment of these patients. Among the most successful *resorts* in America for cases of this class are French Lick and West Baden, Indiana. It is the custom there for patients to rise early, about 5 o'clock during the milder season, and drink several glasses of the Pluto Spring water. It is laxative and diuretic and has the great advantage of annulling, for a time at least, the craving for alcoholic liquors. The author has had repeated testimony on this point and has been impressed with the results which have been obtained in a comparatively short period. Several quarts or even gallons of this water are taken daily by the thousands of visitors who visit these resorts from Chicago, St. Louis, Cincinnati, and other cities in the United States.

In **delirium tremens** the hot wet blanket pack is very useful in calming the patient and promoting sleep.

DIGESTIVE DISORDERS

These affections are most obstinate, being usually constitutional or of slow onset, and controlled by long-standing habits of the body which require months or years of well-directed treatment to correct. Medicinal treatment without dietetic, hygienic, and hydrotherapeutic measures is as "sounding brass or as a tinkling cymbal," to use the historic phrase. Patients with chronic gastro-intestinal disease are frequently depressed in spirit, do not sleep well, and are loath to acknowledge improvement if it occur. By the employment of hydrotherapy sleep may be improved and the abdominal circulation stimulated in such a way as to favor the elimination of toxic materials, especially when suitable mineral waters are administered. These latter, however, are often used without any judgment. Stomachs can easily be ruined by pouring in large quantities of water containing sulphate or carbonate of lime or using strong solutions of lithium carbonate as prepared by dissolving the tablets at the table.

CONSTIPATION

In fairly robust persons whose circulation is good the application of a cold pack or compress to the abdomen every morning may be given a preliminary trial. The cold compress should be changed once or twice during the ten or fifteen minutes of the application. Where there are suitable appliances, a cold douche at 65° or 60° F. (18.3° or 15.6° C.) may be applied for one or two minutes at 15 to 20 pounds' pressure. This will probably give better results in obstinate cases than the compress or pack. The reaction which ensues is accompanied by an increase of blood in the abdominal vessels, thus favoring functional activity.

In patients not so robust, and with sluggish circulation, a hot douche or warm application may be made at first, and later the temperature may be lowered on successive days.

Compresses are more suitable for old and feeble patients than the more formidable treatment by douches. As many cannot incur the expense or inconvenience of institution treatment, simpler measures are more likely to be adopted. The cold compress, or *Neptune's girdle*, placed over the abdomen and renewed every four hours, may afford the desired stimulus. (See p. 356.)

In **spastic constipation**, all forms of colic and muscular rigidity accompanying inflammatory conditions, fomentations must be used. They should be of generous dimensions, extending well beyond the borders of the irritable and painful area, should be wrung dry to avoid blistering, and should be changed every five or ten minutes and covered with rubber or any permeable material which will retain the heat. One, two, or more layers of thick cloth, flannel, or felt make a satisfactory medium to carry the water. When, in addition to heat, a counterirritant is desired, a small amount of mustard or turpentine may be added to the water for the fomentations (Gant). A hot-water coil may be used, but is not so efficacious; the covered electric compress or cushion will be found very useful.

Chronic Constipation.—The *atonic variety* and the *spastic variety* should be carefully distinguished. In the former, every

measure tending to improve the tone of the muscular system is called for. If possible, the hot-air or electric cabinet should be used to produce perspiration, followed by circular jet, Scotch, and fan douches. These measures should then be followed by skilful abdominal and general massage:

Hot-air bath to gentle perspiration.

Circular douche, 105° to 95° F. (40.6°–35.° C.), one minute; 20 pounds. .

Scotch douche, $\frac{1}{4}$ -inch nozzle to the course of the colon, 60° and 112° F. (15.6° and 44.5° C.), fifteen seconds each, alternating for one or two minutes; 20 pounds.

Fan douche to chest and back, 75° F. (23.9° C.), ten seconds; 20 pounds. Repeat daily, increasing pressure 1 pound daily until 30 pounds are used. Walk in the open air afterward.

Or the following:

Wet pack; temperature of water 60° to 70° F. (15.6°–21.1° C.), one hour. Circular douche, 85° F. (29.4° C.), fifteen seconds; 20 pounds. Repeat daily. Once or twice a week a circular douche at 90° to 75° F. (32.2°–23.9° C.). Fan douche, 85° to 65° F. (29.4°–18.3° C.), five seconds; 20 pounds.

The *differential diagnosis* between atonic and spastic constipation is often very difficult and sometimes impossible.¹

Spastic constipation is stated to be found more frequently the more carefully it is sought for. In the female at least 25 per cent. of the cases are of this form; and many of the most persistent cases of chronic constipation, refractory to all methods of treatment, are of this type. As the treatment of this form of constipation is diametrically opposite to the atonic form, it is not difficult to see why so many patients with constipation are treated for years without success.

Spastic constipation, according to Dr. Albu, is most frequently found in neurasthenic and hysterical individuals, most often females. They are weak, poorly nourished, somewhat pale and anemic, and in the third or fourth decade of life.

A perfect knowledge of the syndrome of the malady, there-

¹ A. Albu, of Berlin, in Med. Record, July 1, 1905.

fore, must be obtained in order to outline an intelligent course of treatment.

As these spasms sometimes develop on the basis of atony, every occasion for exciting them must be avoided. Every irritation of the intestines, and especially massage, which is very effective in the atonic form of constipation, must be avoided. Albu recommends the use of:

Warm or hot sitz-baths for from fifteen to twenty minutes at a time.

The application of hot compresses to the abdomen, which not only lessen the spasm but also relieve the colic.

Chronic constipation has sometimes been cured by injecting into the bowel $\frac{1}{2}$ pint of cold water on rising, and retaining this until after breakfast. If too cold, retention may be impossible, but the bowel can be accustomed to hold this quantity by properly grading the temperature. Cold-water enemata can be more readily dispensed with than large warm enemata.

Warm enemas of linseed oil or olive oil, $\frac{1}{4}$ liter every evening, given in bed, with the hips elevated or in the knee-elbow position, and retained over night if possible. The object of this treatment is not to produce bowel movements, but to act as a sedative on the spasm of the intestinal muscle, and should, therefore, remain in contact with it as long as possible.

Large warm enemata are liable to engender the enema habit. This may be broken by lowering the temperature of the water each day 5 degrees, and lessening the amount $\frac{1}{2}$ pint.

GASTROPTOSIS

Gastrophtosis may be treated by the following procedure, advocated by Dr. George Roe Lockwood:

About 11 o'clock in the morning a warm or hot bath at 105° F. (40.5° C.) is given for five minutes. This is followed by a spinal douche at 100° to 102° F. (37.8° – 39.9° C.) for ten seconds at 15 to 20 pounds' pressure. The patient is then placed in bed and a hot wet flannel compress or one of spongiopiline

sufficiently large to cover a good portion of the abdomen is placed on the epigastrium. This is kept hot by a covered electric pad and is changed every two hours by day and once at night. The whole application is to be tightly applied by an elastic binder.¹

CHRONIC GASTRITIS AND ENTERITIS

In these conditions the half-bath, which combines moisture, temperature, friction, and force, is a favorite measure abroad. (For technic see p. 243.) It may be followed by the *pail-pour*, which consists of pouring water from a pail held about 4 feet above the patient. This pail-pour is repeated three to six times. It seems to enhance the good effect of the bath. Winternitz has termed this *thermic massage*. The hot-air bath may be used previous to the half-bath, producing a stimulating and refreshing sensation and a tonic improvement.

ROUND ULCER OF THE STOMACH; HEMORRHAGE

In this affection apply a cold compress to the stomach, covering this with a coil through which ice-water flows continuously for several days if necessary. A sheet may be wrung out of cold water, laid over the trunk, tucked in at the sides, and the cold coil placed on top of this.

In the hyperesthesia of gastric disorders the electric heating pad to the stomach and warm hip-bath frequently afford relief.

Sadger has given his experience with hydrotherapy in the case of hemorrhage from gastric ulcer.² He states that he has often found that small pieces of ice introduced into the rectum act like magic in arresting acute hematemesis. Cold fluids introduced into the rectum, he found, reduce the temperature of the stomach in some way. Swallowing scraps of ice has the opposite effect, and actually favors hemorrhage as the water accumulates and becomes warm. A cold coil over the stomach, over a cold compress, is an effectual adjuvant, the flow of ice-cold water through the coil being kept up continuously possibly

¹ Medical Record, July 20, 1907.

² Abstract in Jour. Amer. Med. Assoc., April 14, 1906.

for a week. A sheet is wrung out of cold water and laid over the trunk, tucked in around the sides, and over this the cold coil is applied over the stomach. The patient is fed with tepid sweet or sour milk in small portions for four or five weeks. Sadger commences with a teaspoonful every fifteen minutes and increases the amount to a tablespoonful, then to half an after-dinner coffeecupful, and finally to a teacupful, increasing the intervals to thirty or sixty minutes. He insists on this diet after acute hemorrhage and also in the treatment of chronic ulcer. Even on the day of the hemorrhage it is possible to commence with minimal amounts of the milk (ice cold). Sadger quotes from Winternitz that the factors inducing round ulcer of the stomach are a chlorotic tendency, reduction in hemoglobin, reduced alkalinity of the blood and hyperacidity of the gastric juice, with spasmodic contraction of the blood-vessels in the stomach mucosa. These factors, he says, induce a predisposition to gastric ulcer. Hydrotherapy, which has such a powerful action on all these factors, forms thus a truly causal treatment for the resulting predisposition to gastric ulcer. It seems to be the general experience that the main contingent of gastric ulcers is presented by chlorotic girls. The chief reliance is on general stimulating measures, with procedures to influence the circulation in the stomach lining and walls. These include cold sitz-baths for about four minutes, stimulating packs, generally in combination with the hot coil, which, however, is never left in place for more than ten or fifteen minutes. Sometimes the cold coil is applied to the heart to improve the general and local circulation. These measures are supplemented by a strict milk diet. Sadger applies an abdominal pack, changed every three hours. Once or twice a day a coil of hot water (104° F.— 40° C.) is inserted in the pack for ten or fifteen minutes. Once a day a sitz-bath is taken with water at 46° or 57° F. (7.7° or 13.8° C.) for from three to five minutes. Early in the morning the body is rubbed off with a cloth wrung out of very cold water, avoiding the chest and abdomen. Later, alternating hot and cold procedures are used. A good arrangement for home use is a cold

pack until the sheet gets warm (twenty to thirty minutes), with a half-bath afterward at 68° or 70° F. (20° or 21.1° C.) for two or three minutes. Milk is the only food allowed for four or five weeks, commencing with a teaspoonful every fifteen minutes. The milk must always be very slowly sipped.

ATONY AND ENTEROPTOSIS

Atony and enteroptosis may also be helped, when spastic constipation is absent, by cold abdominal douches, such as mild jet and fan douches, and by abdominal massage. The preliminary warm bath, hot-air bath, or electric-light bath until perspiration is free is followed by a short cold application administered by rubbing the patient with a mitten or coarse towel wet with water at about 60° F. (15.6° C.), or by giving the patient a cold douche at 70° to 60° F. (21.1°–15.6° C.) for five to twenty seconds. The temperature should be lowered 1 degree daily and the pressure increased by 1 pound from 15 to a maximum of 30 pounds. This stimulates the circulation, prevents auto-intoxication, and improves the muscular tone. Intestinal lavage and irrigation are also useful. This may relieve the "*morning diarrhea*" of atonic dilatation of the stomach.

NERVOUS DYSPEPSIA

The measures described for atony and enteroptosis are sometimes useful in nervous dyspepsia. If a choice can be made that is practicable and that can be adopted for two months or more, an impress can usually be made on this obstinate affection.

The sitz-bath at 50° to 60° F. (10°–15.6° C.) for three, five, or eight minutes is also beneficial.

General tonic measures, such as electric-light baths followed by douches, are indicated, but these cases are proverbially obstinate. It should be stated in this connection that the general effect of cold bathing is to diminish intestinal putrefaction.

PERISTALTIC UNREST

In the condition known as peristaltic unrest of Kussmaul the hydrotherapeutic measures used for neurasthenia should be tried. These, with lavage of the lower bowel, give very satisfactory results.

CHOLERA INFANTUM

When the temperature is high, bathing should be employed at a temperature of only a few degrees below that of the body. The warm mustard bath, made with one or two tablespoonfuls of mustard enclosed in cheese-cloth and placed in a small tub of water at 98° to 100° F. (35°–37.8° C.), may be used. The child, whose ears are protected with a little cotton plug, is put in the bath at the same time that the mustard is added at the foot of the bath-tub. The duration of the bath may be from four to five or eight minutes or until the person holding the child finds some reddening of her own skin. The child is then dried and dressed in night clothes and returned to bed. Marked improvement of the general circulation and the breathing, and a quieting effect on the general nervous system will be noted as the results.

Cold baths and ice-water injections into the bowels are not to be recommended, although they have been advocated by some. When no reaction follows the mustard bath the prognosis is not good.

Dr. Forehheimer adds a word of caution regarding the *eyes* in giving mustard baths to children. The eyes should be kept clean and protected not only in the mustard bath, but throughout the course of cholera infantum in order to prevent infection. Normal salt solution, with boric acid, if necessary, should be dropped into the conjunctival sac, and when, as is usually the case, the lids are open the eyes should be kept constantly covered with moistened lint to prevent ulcer of the cornea. (See also p. 227.)

PERITONITIS AND APPENDICITIS

Cold applications are to be preferred to hot ones in these conditions. In general peritonitis cold is applied by means of ice, using the ice-poultice or ice-bags. These measures are also indicated in appendicitis previous to operation. The bag should be suspended so as not to rest too heavily on the patient. Too persistent application of cold acts as a marked depressant, and unless gauze is interposed, ice-bags and ice directly applied to the abdominal wall may produce gangrene. Such accidents have happened and have given rise to law suits.

Cloths wet in ice-water may be used instead of the ice-bag, changed frequently.

Murphy's method of proctoclysis has yielded good results in these cases. (See p. 361.)

SEASICKNESS

The full hot, dry pack to the entire body, including the head, is a simple effective remedy for seasickness. This should be kept up until the superficial vessels are fully dilated. Hot towels to the head are also useful at times. The electric pad applied to the stomach is nowadays a practical measure on the ocean steamers.

ANEMIA; CHLOROSIS; CONVALESCENCE FROM ACUTE ILLNESS

In treating these affections the aim is to stimulate all the sources of the body heat to a powerfully increased function. The first step is to warm the body, applying afterward vigorous brief thermic and mechanical stimulation of the nerves. Nothing accomplishes this so well as the hot-air cabinet succeeded by the circular douche, jet, and Scotch douches, followed then by an alcohol rub.

ANEMIA

Great improvement follows judicious hydrotherapy in this disease. To improve the circulation, the digestion, and the

excretion are the main aims. These may be attained by warm baths or cold baths; by hot-air baths followed by appropriate douches, the so-called *tonic baths*; by drip sheets, cold packs, and the judicious use of nearly every hydrotherapeutic measure. Cases of pernicious anemia are sometimes arrested and started toward recovery by these methods in connection with internal treatment. At times internal treatment is not well borne, and physiologic therapeutics become the mainstay.

In **mild grades** of anemia with fair resistance, the author usually employs the hot-air cabinet or the electric-light cabinet, followed by the circular douche, jet douche, Scotch douche, fan douches, and a drying rub and friction with alcohol. The prescription may read as follows:

Hot-air bath, eight to ten minutes or to beginning perspiration.

Circular douche, two minutes, 105° to 90° F. (40.6°–32.2° C.), 20 pounds.

Jet douche, one minute, 100° to 80° F. (37.8°–26.7° C.), 20 pounds.

Scotch douche, twenty seconds, 105° and 80° F. (40.6° and 26.7° C.), 20 pounds.

Fan douche, ten seconds at 78° F. (25.6° C.).

Alcohol rub. Reduce minima 1 degree daily to 60° F. (15.6° C.).

When cabinets and douches are not available, simpler measures, such as the systemic use of the drip sheet at bedtime, the half-bath, warm or cold baths, followed by friction, may be employed. Warm salt-water baths are useful. In summer sea-baths at moderate temperatures and sun baths on the beach before and after the bath may be helpful, but have to be taken with judgment. In this way a good reaction is obtained and the tone of the skin is greatly improved.

In **extreme anemia** the patient is usually too weak to stand while douches are administered, and hence graduated brine baths with effervescing carbon dioxide are recommended and can easily be carried out at home. The natural carbon dioxide baths at Nauheim, Carlsbad, and elsewhere may be taken where the means and convenience of the patient permit. Baths containing iron sulphate are useful for their astringent and bactericidal

effect on the mucous membranes, especially where vaginal catarrh is associated with the anemia.

In employing hot baths it is best to give them on alternate days at first, so that the patient can have massage and uninterrupted outdoor rest, with perhaps moderate exercise, on the intervening days. The best time for these baths is in the forenoon and about two hours after breakfast. The temperature should be from 102° to 104° F. (38.9°–40° C.). At first of ten minutes' duration, the bath may be lengthened to twenty minutes. A cool or cold cloth is kept on the entire scalp and frequently wrung out in cold water during the progress of the bath. Rubbing in the tub is advised. When the patient is taken out he is sponged up and down the spine or all over with water at 70° F. (21° C.), and in this way is educated to the use of a cold douche by the time for the third or fourth bath. The cold water from a hose may be gradually lowered in temperature as the treatment progresses and the patient gains strength.

If the patient is not too weak, the Turkish bath is useful in promoting good circulation and improving the condition of the blood, particularly is it beneficial if associated with a redundancy of fat. In this latter connection massage is a most valuable adjunct. (For the effect of hot and cold applications on the blood and the blood-vessels, see pp. 56 and 210.)

CHLOROSIS

Cold sitz-baths for about four minutes or stimulating hot packs, generally in combination with the hot coil, favor circulation in the stomach-lining and walls, and are suitable in chlorosis. The hot coil should be left in place not over ten or fifteen minutes.

The cold coil may be applied to the heart to improve the general and local circulation (see pp. 102 and 357).

Nearly all cases can be benefited by some system of neuro-vascular training by hydrotherapy.

The following prescription is suitable for moderate cases of chlorosis and anemia:

Electric-light bath, fifteen to twenty minutes.

Fan douche, 105° F. (104.5° C.), thirty seconds, 20 pounds.

Fan douche, 70° F. (21° C.), fifteen seconds, 20 pounds.

Dry rub.

Rest one hour.

Repeat every other day.

If the patient is rather weak, the time in the electric-light cabinet may be shortened, and instead of the douche give a cold wet mit friction with water at 70° F. (21° C.), reducing it daily 1 degree.

VASOMOTOR SPASM AND VISCERAL ANEMIAS

Hot mud baths are sometimes of great benefit. Mountain spas are of great value in anemia and chlorosis.

For vasomotor spasm and visceral anemias such measures as the general Scotch douche, warm visceral or abdominal douches, short percussion douches, alternate hot and cold compresses, etc., are very effective. Cold sponging over the spine and outside and inside of thighs increases elimination and stimulates circulation. Constipation may be relieved and peristaltic activity increased by drinking a glass of cold water, preferably carbonated water, before breakfast; small cold enema; fomentation with water at 120° F. (48.8° C.) over liver twice daily, followed by heating compress during interval; wet girdle at night; cold fan douche to abdomen; cold percussion douche to spine; abdominal massage. Douches generally act better when preceded by some warming process.

SPLENIC ENLARGEMENT

Mosler¹ states that the application of cold water to the abdomen produces contraction of the spleen, and that the cold douche applied for two or three minutes, and repeated at longer or shorter intervals, very sensibly affects the enlarged spleen of intermittent or typhoid fever and even of such chronic diseases as leukemia, in which class of cases the application should be twice a day (H. C. Wood).

¹ Virchow's Archiv für Path. Anat. und Phys., lvii.

NEURASTHENIA

Most neurasthenics are benefited by hydrotherapy and nearly all of the various baths that promote healthy reaction may be employed. The best of these are the drip sheet, alternate hot and cold sponging of the spine, the tonic treatment by means of the hot-air cabinet, the circular douche, jet, Scotch and fan douches, and subsequent rub.

The salt rub, preceded and followed by a spray or fan douche, is an excellent measure and easily applied (see p. 354). The temperature of the spray should be between 92° and 99° F. (33.3° and 37.2° C.) and should occupy from four to eight minutes. Beni Barde, of Paris, applies the spray along the spine, then the anterior surface, and then the limbs, making the application twice a day.

If all sudden shocks are avoided, sleep is favored, nervous agitation ceases, and the patient is generally soothed. The temperature of the bath toward the end may be reduced a trifle.

Cool or cold water bathing is not always beneficial to the neurasthenic, at least at first. Patients will be met with who, for some mysterious reason, do not bear any of these measures very well. They seem to be greatly fatigued by them. In such cases one may have to be content with a general sponge three times a week. Cases of chronic fatigue are poor subjects, just as it would be improper to give a cold bath to a healthy person greatly fatigued by exercise. If such be given, there may be a secondary feeling of drowsiness or lassitude. If any hydrotherapeutic measure at moderately low temperature applied for neurasthenia produces an unpleasant effect, it would probably be corrected by raising the temperature, lowering the pressure, and shortening the bath. The types of neurasthenia are so various and individual peculiarities so diverse that every patient must be judged separately.

Much can be done by way of cultivating the resistive powers of these patients. A routine bath is always to be deplored, but especially here. Individualization, education, and persistence

should mark the treatment of these cases. Just as in applying electricity to a neurasthenic man or woman, it is safer at first to apply the electrodes without current, so unusual care should be exercised that no shock be given from the use of either very hot or very cold water. Dr. Baruch told the writer that he considered his principal contribution to the technic of hydrotherapy to be the educational bath. To render this feasible by definite gradations of pressure, temperature, and duration he had the douche table constructed which is identified with his name (see p. 282). In other words, the successful treatment of these cases depends on intelligent dosage.

The most successful method of treating neurasthenia is that which was first formulated by Dr. Weir Mitchell forty years ago. This celebrated plan of the "rest cure" embraces, among other physical methods, hydrotherapy. During the earlier stages of treatment the drip sheet is usually suitable and advised by Dr. Mitchell, the technic of which is described on p. 246. It has the advantage, in common with the cold pack, of being applied while the patient remains in bed, and does not require apparatus. During the later period of treatment, if the patient is in a hospital or sanitarium, it is easy to employ cabinet baths either by hot air or electric light, followed by the needle (circular) douche, jet, and Scotch douches. Salt rubs are easily given and may prove useful in any stage of the treatment. Friction with a dry towel after cold packs, sprays, and douches is highly important to secure reaction.

Neurasthenic patients need the neurovascular training instituted and described by Dr. Baruch, and it is necessary to be extremely cautious in the use of cold. By tact and perseverance and the use of mild measures at the outset these highly sensitive subjects may be trained to react, and will become interested in the measures adopted and eventually recognize the good effect to the circulation. Not the least of all the benefits derived will be the cultivation of a healthy state of will power and the return of hope, which is always a very small asset in the neurasthenic patient. There are various trying symptoms of neurasthenia

which demand special forms of treatment. The insomnia is sometimes relieved by the application of dry cold to the spine for an hour in the evening.

Douche or Control Table.—In carrying out treatment with the aid of this apparatus the author directs the use of the hot-air cabinet short of perspiration; this takes six, eight, or ten minutes at a temperature of 170° or 180° F. (76.7° or 82.2° C.). The electric-light cabinet may be employed, as a rule, in place of the hot-air cabinet. Then one or two minutes in the circular douche, the temperature being reduced in the time allowed from 105° to 90° F. (40.6°–32.2° C.), and the pressure being 15 pounds. Then the jet douche for fifteen or thirty seconds, reduced from 90° to 75° F. (32.2°–23.9° C.), at the same pressure; followed by the fan douche at the same pressure and at 75° F. (23.9° C.).

From day to day the temperature of the terminal douche is reduced 1 or 2 degrees until 65° or 60° F. (18.3° or 15.6° C.) is reached; the pressure is raised to 20 pounds. The jet and circular douches are correspondingly raised in pressure. The temperature can be lowered and the pressure raised more rapidly in some cases, especially in those in which good reaction takes place in the first or second bath. As in all other educational processes, some subjects progress rapidly, while others are more sluggish. Hence, the physician must be in touch with the operator, receive immediate reports, or, better still, if possible, watch the procedure. In Paris the author found that the doctors in charge of the hydrotherapeutic establishments gave all the douches personally to men and women alike. In hospitals, sanatoria, and health resorts this oversight is better systematized than elsewhere and often accounts for the better results obtained. Some institutions and resorts in the United States provided with douche tables are mentioned on pp. 284–286.

Prolonged hot baths, the hot spout, and hot packs are not suitable measures in neurasthenia; the ultimate effect of these, even when followed by a cool shower or douche, is bad.

SEXUAL NEURASTHENIA

Good results follow cold bathing in the morning. The patient is made to stand in a bath-tub containing warm water, while cold water, preferably at a temperature of 55° to 70° F. (12.8°–21.1° C.), according to the temperature of the available supply, is made to flow from the occiput to the spine. Two or three minutes at first and later five minutes will suffice. The patient should rub himself briskly. Good food with moderate doses of strychnin or phosphorus aid the treatment. Local treatment of all kinds should be avoided.

SPERMATORRHEA

Cold water ablutions are often advised, but, on account of the strong reaction produced, are not so beneficial as those with lukewarm water without active rubbing of the body surface. The skin may be dried by merely applying the towel, or it may be allowed to dry spontaneously.

Impotence, with general muscular weakness, loss of tone, lack of general strength and vitality, accompanied by imperfect and rapidly subsiding erections, should be treated with cold perineal douches having a moderate force and for considerable lengths of time: (See *Ascending Douche*, p. 262.)

In applying cold water it should be dashed or sopped against the perineum or the scrotum. The scrotum may be submerged in a tumblerful of cold water for one or two minutes each night, at the same time applying cold to the lumbar region.

Some years ago Dr. J. William White advocated strongly the use of the bidet.¹ This attachment to the bowl of the ordinary water-closet allows a current of cold water to be directed gently upward against the parts. While the principal is a good one, the arrangement has many objections and has fallen into disuse.

¹ See Hare's Therapeutics, 13th edition, article on Cold.

NEUROSES OF THE BLADDER

In enuresis nocturna it is best to try the half-bath, and later, in older children, a cold rain douche. Affusions with water at 60° F. (15.6° C.) may be used.

In all neuroses suggestion of cure by the means employed should not be forgotten.

INSOMNIA

Whatever the cause of insomnia, whether due to pain, the irritation of cough, to gastro-intestinal affections, to high arterial tension, or to low arterial tension, there is one condition which is generally considered necessary to sleep, and that is a state of cortical anemia. Hydrotherapeutic measures must be chosen with this end in view, and, fortunately, most of them are applicable. The late Sir William Broadbent, in a critical analysis of the various cause of insomnia,¹ discusses the influence of high and low arterial tension. High blood-pressure is not by any means invariably attended with sleeplessness, but it is a contributory cause of the sleeplessness of old age, of arterial degeneration, and of renal disease. The blood-pressure overcomes the resistance in the cerebral arterioles and maintains an active blood supply to the cortex which is inconsistent with sleep. When no other cause of habitual difficulty and delay in going to sleep can be found and the pulse tension is high, the possibility that this is a cause must be entertained.

Sir William Broadbent remarks that "When cold feet interfere with sleep, it is not merely through the feeling of cold as such, but by an influence on the general and cerebral circulation. Coldness of the feet, indeed, is often a concomitant of sleeplessness, rather than its cause, and an incident of general vasomotor disturbance, which may be a gastro-intestinal reflex. When the feet are cold after hard brain work, the blood seems to be positively shut off from the feet. A hot bottle is then often of no use, and the best way of warming the feet and procuring

¹ The Practitioner, London, July, 1906.

sleep is to stand in cold water (preferably running water) and then rub the feet dry with a rough towel."

In the majority of cases the warm bath, 90° to 98° F. (32.2°–36.7° C.), or the full hot bath, 98° to 104° F. (36.7°–50° C.), at bedtime may be found successful. The author has found it necessary to prolong the duration of these baths from ten to thirty minutes in obstinate cases and to have them repeated several times during the night. The attendant should not fail to keep the turban wet with cool water, changing it frequently, so as to keep the head cool. The patient should be rubbed dry quickly and put in bed. On a succeeding night the wet pack should be tried should the treatment just detailed prove ineffectual. Friction of the entire body should be given after the pack. The drip sheet has also proved useful in many cases (see p. 246).

The prolonged tepid bath, 96° to 100° F. (35.6°–37.8° C.), just before bedtime may also give relief. After about fifteen minutes the patient is quickly dried without much rubbing and given a cool foot bath, with brisk rubbing of the feet. The head should also be wet with cool or cold water.

In cases attended with overactivity of the cerebral circulation, the spinal douche, with brisk rubbing of the body and cold applications to the head, often aids other forms of treatment. The object is to secure cutaneous hyperemia without perspiration.

Rationale.—Primary effect: Contraction of the capillaries of the surface and hyperemia of the brain and internal organs. Secondary effect: Hyperemia of the skin; depletion of the brain.

The use of a towel wet in cold water placed around the neck while the patient is in bed may also be successful; or the feet and ankles may be placed for fifteen minutes in hot water.

Local packs to the legs and to the abdomen may also be tried where tubs are not at hand. The abdominal pack, called *Neptune's girdle*, is described on p. 356. In any case it is desirable to make cold applications to the head with free use of water

on the face and forehead. The sitz-bath, in water at 70° to 75° F. (21.1°–23.9° C.), for ten to twenty minutes, with the feet and legs well covered, is useful in the insomnia accompanying sexual neurasthenia, or hypersensitive conditions. Whether cold baths, half-baths, or sitz-baths are used, it is better not to dry the patient completely, but let him quickly put on night clothing and get into bed. Forehheimer gives the preference to the general moist pack carefully applied and continued for one to two hours.

Sea-bathing.—In suitable localities sea-bathing may be found very useful, but the drowsiness which follows prolonged sea-bathing is undesirable and may be an index of physical weakness. Used with judgment, moderate sea-bathing will favor natural sleep.

INSANITY

Currie used cold baths in insanity in 1796, and records several cures of maniacal patients by throwing them “headlong into the cold bath.”¹

The following is from the record: “The direction had been followed, and on the morning of the 23d he was again thrown into the cold bath in the height of his fury, as before. As he came out, he was thrown in again, and this was repeated five different times, till he could not leave the bath without assistance. He became perfectly calm and rational in the bath, and has remained so ever since. He never relapsed and was discharged some time afterward, in perfect health of body and mind.”

Systematic treatment of the insane by means of hydrotherapy has been carried out with considerable success in this country at the United States Government Hospital for the Insane, Washington, D. C.; at the Sheppard and Enoch Pratt Hospital, Towson, Md.; at the Eastern Maine Hospital for the Insane, at Bangor; The Craig Colony for Epileptics, at Sonymea, N. Y.; the McLean Asylum, Waverly Mass.; at the Danver’s Asylum, Mass.; at the Butler Hospital Providence, R. I.; at the Columbus State Hos-

¹ Op. cit., pp. 21 and 59.

pital, Columbus, Ohio; at the Ohio State Hospital for the Insane, Massillon, Ohio; at the University Hospital, Ann Arbor; at the Philadelphia General Hospital (Blockley); at the Pennsylvania Hospital for the Insane; at the Morris Plains State Hospital for the Insane; at the Manhattan State Hospital for the Insane, Wards Island, N. Y.; at the J. Hood Wright Hospital, N. Y.; and also at various private institutions, such as Dr. Parson's, at Ossining, N. Y., and Dr. Bond's House at Yonkers, N. Y.



Fig. 40.—Continuous baths, showing an insane patient in the tub. One attendant is assigned to two patients.

They are all equipped with modern douche tables and many with continuous baths. One of the first to report on the results of treatment was the late Dr. G. W. Foster. His report, published in 1899,¹ gives the results of treatment in 12 epileptics and 21 cases of paresis. The average duration of treatment of the epileptics was over seven months. In every case but one a marked improvement, both mental and physical, followed. The average loss in number of fits was 40 per cent. The cases of

¹ American Journal of Insanity, vol. lv, No. 4.

general paralysis of the insane were naturally not so satisfactory, although 3 were reported as arrested and 6 improved. Of course, in the absence of precise objective data by which a comparison may be made of the patients' mental condition before and after treatment, the judgment of the medical attendant must alone be relied upon.

Dr. Foster reported 3 cases of acute mania recovered; 2 of acute dementia; 1 of acute melancholia, and 1 of morphinism.

The late Dr. Dent also reported great success in the treatment of insanity. The same methods have been continued by Dr. William Mabon in the Manhattan State Hospital, New York.

Dr. B. R. Logie has continued this method of treatment at the United States Government Hospital for the Insane during the last six years, applying it to all forms of insanity. In mania with depression he believes the disease has been shortened and the symptoms modified from the beginning. Nearly all of these cases have made rather rapid and good recoveries, prolonged periods of excitement having been rare.

In a personal communication, dated February 21, 1905, Dr. Logie writes: "In all cases of excitement and depression I would oftentimes be able to relieve the symptoms. In epilepsy I believe that during the period of active treatment in a number of instances the attacks were greatly reduced in number, and perhaps not so severe at the time of occurrence. In the paretic and the large class of chronic insane, including, of course, the dementias, I have been able, by keeping in first-class order the physical condition, and by especially directed efforts toward such symptoms as excitement and depression, to render the patients comfortable, and perhaps to prolong their existence. Personally, I approve of the treatment, and believe that it stands to-day without a rival.

"My methods of applying the treatment are few, owing to the fact that experience has apparently demonstrated that there are only a few procedures which it is really worth while to use. As a matter of routine, then, I have adopted these, and, altering

them to suit any case, have confined myself almost exclusively to their use. The most prominent of these procedures is as follows: First, the cold wet pack; second, the hot-air box. After each I am in the habit of dressing the patient either by cold towels or, preferably, the Scotch douche. In cases that are very much excited I use, as a rule, a warm bath, temperature about 112° F. (44.4° C.), followed by a prolonged submersion in the neutral bath." The author does not advise so hot a bath.

The author would advise in all cases of moderate excitement a hot wet pack as a sedative. A blanket is laid on the bed and a linen sheet wrung out of hot water is quickly spread over the blanket. The patient, whose clothes have been removed, is then laid upon the sheet, which is folded about him and then enveloped in the blanket. A cold compress should be applied to the head. The result is a relaxing neutral pack when the temperature of the skin and sheet are equalized.

The hammock has been utilized to hold very violent patients in the continuous bath, using water at 100° F. (37.8° C.), with a remarkable sedative effect. This is the best tranquillizing procedure when prolonged.

The tubs used for the continuous baths in the Manhattan State Hospital are large and deep, with rolling edges, and under the edges are hooks for the attachment of a canvas hammock upon which the patient lies. There is an inlet at the head of the tub into which the water runs continuously while the tub is in use, and three outlets at the foot, one near the top which prevents overflow, one at the bottom, and one near the middle with a large stopper, by which the tub can be emptied of all excreta. The flow of the water and its temperature are controlled entirely from the table, and in addition to this, in order that all possible danger of mistake may be avoided, a bath thermometer is kept in the tub tied to its edge. The thermometer in the tub registers a slightly lower temperature than that shown on the control table, the difference varying from 1 to 3 degrees, according to the apparatus.

The patients treated by these baths are restless, delirious, and violently disturbed cases. They are kept in the tub usually for the entire twenty-four hours without removal except for cleaning the tubs, and for a sufficiently long period to allay their excitement, varying from a day to two or three months.

The following is the routine procedure of preparing the tubs for and placing the patient therein:

In the first place the tubs are drawn half-full of water, the hammock placed in position, and the patient, wearing a chemise, placed on the hammock; across the whole length of the tub are stretched sheets tied at each side, thus entirely covering the patient except her head, which rests upon a rubber air-cushion. If the patient is very disturbed and assaultive, it may be necessary to wrap her in sheets secured with safety-pins until she become quiet. The water is kept at a temperature of from 98° to 100° F. (36.6°–37.7° C.) except in very hot weather, when it is sometimes allowed to drop to 95° F. (35° C.). Every morning the patient is removed for an hour while the tub and the hammock are cleaned and the patient's entire body anointed with some bland ointment to prevent irritation from the continuous application of the water.

A nurse in charge of the bath-room is on duty eight hours; her duties are to watch the temperature of the water, attend to the ventilation and keep the patients as quiet as possible, take their temperature twice a day or oftener if ordered, and feed them unless they are able to feed themselves. Each nurse, as a rule, has two patients. There are ten such tubs in all throughout the hospital. (See also pp. 287–291.)

MELANCHOLIA

In the incipient stage prolonged warm baths are useful, but should not be continued to the point of marked muscular debility. A change should be soon made to the more tonic form of treatment by the hot-air cabinet, circular, jet, Scotch and fan douches, followed by alcohol rubbing. A good prescription for fairly robust cases would be as follows:

Electric-light or hot-air cabinet, eight to ten minutes, or to perspiration. Circular douche, two minutes, 105° to 90° F. (40.6°-32.2° C.), 20 pounds. Jet douche, one minute, 100° to 80° F. (37.8°-26.7° C.), 15 to 20 pounds. Scotch douche, twenty seconds, 105° to 80° F. (40.6°-26.7° C.), 15 to 20 pounds.

Fan douche, ten seconds, 78° F. (16.7° C.), 20 pounds.

Dry with friction and follow with an alcohol rub. Reduce minima 1 degree daily until 60° F. (15.6° C.) is reached.

The Scotch douche may be omitted at the commencement of treatment in most cases.

Artificial Nauheim Baths.—The author would call attention to the excellent effect of the artificial Nauheim baths in all mental cases. He has had excellent results in their use. They are easily given in the home or hospital where the more elaborate apparatus is lacking, and it is usually agreeable and interesting to the patient (see p. 311).

Oxygen baths are likewise suitable for these cases.

EXCITED STATES

The **continuous bath** has been introduced comparatively recently into American hospitals for the insane, although for over twenty years it has been used in England and on the continent. The experience at Bethlehem (Bedlam) and Prof. Kraepelin's clinic has been uniformly satisfactory in excited states. In April, 1907, eight continuous baths were instilled in the Philadelphia Hospital for the Insane (Blockley). Since that time the patients treated in this manner included cases of acute, chronic, and recurrent mania; excited types of dementia praecox; maniacal episodes of epilepsy; dementia paralytica and senile dementia; alcoholic insanity, and insanity of chorea. The chief resident physician, Dr. W. W. Hawke, and the assistant physician, Dr. Walter G. Bowers, report great improvement, especially in the cases of mania, excited cases of dementia praecox, senile dementia, and toxic cases, including insanity of chorea. Dr. Bowers furnishes the following notes:

"CASE 1.—Daniel D., aged thirty, white (acute mania). On admission, this patient was garrulous, vituperative, restless,

noisy, and hostile in manner. He was placed in the continuous bath Oct. 16, 1907. The temperature of the water was 100° F. (37.8° C.). Little or no improvement was noted at the end of the first day. On the second day the temperature of the water was raised to 105° F. (40.6° C.). The patient began to show improvement, which gradually continued, and at the end of the fifth day motor restlessness ceased and the patient was no longer garrulous and noisy. In this case a permanent benefit was observed and the patient was discharged a few weeks later, restored.

“CASE 2.—Frank D., aged fifty-five, white (toxic insanity, alcoholic confusional), noisy and restless, fearing that he was about to be killed. The patient was placed in the bath June 19, 1907, at 5 P. M. The temperature of the water was 100° F. (37.8° C.). The patient gradually became quiet, and at the end of the third day was no longer fearful or agitated.

“CASE 3.—John P. R., aged eighteen, white (insanity of chorea). The patient was restless, with general choreiform movements. He was placed in the bath June 26, 1907, at 11 A. M. The temperature of the water was 95° F. (35° C.). At the end of three days movements became decidedly less in number and extent.

“No restraint is used while patients are in the bath. They are allowed house diet, with milk and eggs between meals, and careful attention is paid to the emunctories. Sedatives and all forms of internal medication are removed while the patient is in the bath, save on occasional indication for diffusible stimulants. Despite careful padding of tubs, a few patients developed superficial excoriations over the regions of the scapulæ, shoulders, buttocks, and elbows. Others complained of tender palms and soles, only, however, after being in the tub several days. One case of acute eczema, involving thighs, legs, and feet, which was somewhat refractory to treatment, developed in a colored patient after he had remained in the bath five days.

“In two other cases a skin rash, resembling impetigo, developed, which was transient in character. We have also treated

patients with ichthyosis and psoriasis with at least temporary benefit.

"The same care used in selecting patients for the continuous flowing bath was used in selecting patients for treatment in the douche room and hot-air cabinets, as little save the detergent and slightly stimulating effect of the baths can be expected from hydrotherapy in the treatment of chronic insane. Excellent results were obtained by the use of hot-air cabinets in toxic cases, especially the acute alcoholic insanities, also cases of mania and uremia; patients in such cases were kept in the cabinet until a profuse sweat was produced. While in the cabinet the patients drank freely of water. They were then given a spray and rain bath for three minutes at 95° F. (35° C.), the temperature being gradually reduced to 80° F. (26.7° C.), save in the cases of uremia, in which the patients were given a sponge bath after sweating profusely.

"A number of dementia præcox patients in a dull, stupid, and apathetic state, also a few patients with melancholia and neurasthenia, showed considerable improvement both physically and mentally after use of the spray and rain bath at 90° F. (32.2° C.) for three minutes, followed by the Scotch douche, moderate to full force at 90° F. (32.2° C.), gradually reduced to 75° F. (23.9° C.), for two minutes, the douche being played rapidly up and down the entire length of the spinal column.

"Patients with saturnism, with the associated paralysis, also the polyneuritis of alcohol, with and without Korsakow's psychosis, showed marked improvement and recovery by the use of the hot-air treatment and immersion bath, the patient remaining in the tub thirty minutes and being urged to exercise while in the water.

"Painful and inflammatory hemorrhoids were treated daily with the perineal douche; as a result, the hemorrhoids shriveled up and ceased to be painful and inflammatory. It is recognized that constipation is habitual in the insane. Favorable results were obtained by the use of the sitz-bath and liver spray daily at a temperature of 100° or 105° F. (37.8° or 40.6° C.).

"For the detergent effect, from 10 to 20 patients were sent from the ward daily to receive a rain and spray bath. Four thousand such baths have been given during the past year."¹

Baker² reports the employment of hydrotherapy in 26 cases of melancholia, with or without agitation, dementia praecox, hysteria, puerperal insanity characterized by slowness of thought, painful delusions, etc., cases showing lack of nervous and muscular tone, sluggish circulation, loss of weight, greasy and acne-covered skin, intestinal fermentation, and other complications. The baths in these cases are used for various periods, depending, of course, on the case. He reports decidedly good results, such as quieting of agitation, gradual disappearance of delusions, and physical improvement.

Warm baths or the modified continuous baths may be more conveniently used by day. They should last for from twelve to fourteen hours. Dr. Stockton, in speaking of his experience, says that the patients not only improved, gained in weight, slept better, and became quieter, but that they were also able to dispense with the use of drugs.

Water at the proper temperature and adapted to the individual, adds to the nervous energy, stimulates the functions of the body, and improves the resisting power against disease. The kidneys act more vigorously, the fact that the urine is found to be more toxic after a bath being abundant proof that baths assist in the elimination of poisonous material. It stimulates respiration and so eliminates poisonous matter. The use of baths in no way interferes with the medical treatment of patients, and, indeed, properly administered, they largely increase the efficiency of many drugs and do not interfere with any. The warm bath renders the surface of the body less sensitive, numbs the terminal nerve-fibers, and produces a sedative action. Whenever there is delirium, restlessness, or insomnia, the neutral bath is indicated.

¹ Jour. Amer. Med. Assoc., Oct. 24, 1908.

² Medical Record, Oct. 10, 1908, article by Dr. George Stockton, Columbus State Hospital for the Insane, Ohio.

Removing Patient from Bath to Bed.—Whenever the patient is to be removed from the continuous bath to his bed, as, for instance, toward night, when the treatment is not deemed necessary in milder cases, it is highly desirable to avoid all chilling from the ordinary atmospheric temperature of the room. A hot dry sheet should be at hand to envelop the patient. He is then put in a warmed bed and night clothes adjusted. This will avoid any check to the surface blood and in a measure maintain a good superficial circulation. A steam-heated hot closet should be provided in planning the hydrotherapeutic department of any institution, so that these hot sheets may always be at hand when patients leave the bath, whether of the continuous type or after the routine application of douches. If this be not properly installed, the only recourse is to keep the sheets piled over some convenient steam radiator, although this detracts from the general appearance of the room.

Daily Routine Bath.—Those who have much to do with the insane usually speak highly of the continuous bath, the cold wet sheet pack, the electric-light and steam-heated hot-air bath, the circular (needle) douche, jet, Scotch, and fan douches.

In some of the more modern institutions the patients are formed in line and stand under large overhead showers (descending or rain douche). The douche room should be provided with tubular brass railings to keep the line in order and to give support for the hands of patients who feel the need of it. This daily routine bath with suitable appliances has a wholesome effect on a large class of mental cases, and it can be given to large numbers daily with very few attendants. Excited cases should be treated by other methods, but in time these patients may improve to such an extent as to take the daily bath. The temperature is usually reduced from 100° to 90° or 80° F. (37.8°–32.2° or 26.7° C.), according to the judgment of the attending physician.

General Instructions.—On admission to hospitals for the insane the condition of the patient's skin is usually bad. This is almost invariably the case among the poor, and hence much can be expected from hydrotherapy. Vitality is generally low, how-

ever strong the patient may appear. All demented and melancholic patients are more or less under the influence of an auto-intoxication, and hence hydrotherapeutic measures and intestinal irrigation are called for. Care, however, should always be taken that in using the cabinets, etc., no hot pipes or unguarded electric lights can by any possibility be touched. The least chance of drowning should also be guarded against. It must be remembered that an insane patient may drink the water in the tub, tamper with the fixtures, or break the glass of apparatus in the most unexpected manner.

EPILEPSY

The position of hydrotherapy in the treatment of epilepsy may be considered as a means of cure; an auxiliary method of treatment; a method of making it possible to administer considerably larger doses of bromids than usual; a method rendering it possible to reduce the dose of bromid to a minimum; and, finally, as an excellent hygienic measure favoring the action of the skin, improving the general tone, and favoring the oxidation and elimination of all toxic products.

As a cure *per se* hydrotherapy is probably like all other medicines—it has been tried and found wanting. Notwithstanding the fact that the means employed consist of water, cold, warm, or hot, in tubs, douches, sprays, vapor baths, hot-air baths, and compresses, a method permitting the widest variations in the form of treatment, it probably has rarely, if ever, cured, in and of itself, a case of genuine epilepsy. Cases have been reported cured, as is so frequently done after surgical methods such as trephining, but further investigation shows that there has been some error in diagnosis, the case being one of hysteria, or that relapses have occurred.

A few French authors have advocated hydrotherapy since Fleury, in 1875, published his treatise¹ on the subject. Winter-nitz and his school have declared that hydrotherapy in epilepsy

¹ *Traité thérapeutique et critique d'hydrothérapie*, Paris, 1875; also P. Bricon, Thesis, 1881, from Bourdonville's service at Bicêtre.

employed exclusively produces no effect. On the other hand, some of the more recent German publications look on the subject more favorably. Schweinburg, in his work,¹ cites a patient, a college student, who took, under his direction, half-baths for a year, and later entered official life and has remained well for sixteen years. Schweinburg says that this is not the only similar case in his experience, but, of course, he pays very strict attention to the diet, and he notes that when the epileptic is ordered a combination of hydrotherapy with a rigid dietary the epileptic attacks diminish with very little bromid, so that there is a reduction from 6 to 8 gm. daily to 1 or 2 gm. Long intervals free from attacks are obtained and a general improvement in the mental and physical condition is noted.

The procedure adopted at first was the half-bath at 81.5° to 86° F. (27.5°–30° C.), with affusions and strong rubbing for five or six minutes once or twice daily. Before applying water of lower temperature or more energetic measures, such as douches, slapping, or in using the high temperatures, there should be caution, for attacks have occurred during the application of extreme temperatures.² Wet packs, foot-baths, and cold compresses to the head are useful after severe attacks. No unpleasant results have been noted, no increase in the number of attacks, even in the most unfavorable cases. Schweinburg considers the combined hydrotherapeutic and dietetic method more as a school for patients, who thus learn the principles and practice of hygienic treatment to be followed during the coming years.

Pick maintains much the same position in holding that with hydrotherapy we can employ considerably smaller doses of the bromid than when the latter is given alone. He employs during the interval between the attacks the so-called half-baths at 80.5° to 86° F. (26.9°–30° C.), and of eight to fifteen minutes' duration, as well as sitz-baths and trunk compresses or the so-called *Neptune's girdle*. Without necessarily expecting

¹ Handbuch der allgemeinen und Speziellen Hydrotherapie, Wiesbaden, 1904.

² Binswanger, Nothnagel's Speziellen Pathologie, Breitung, Deutsch. Med. Woch., 1898, No. 39.

a cure, he uses systematic hydrotherapy so as to promote the action of the skin or as a mode of treatment auxiliary to other measures.

Binswanger advises in this connection a mild hydrotherapy as usually adopted in the general treatment of neurasthenia; also a daily bath, using water gradually cooled to 59° F. (15° C.); indifferent baths two or three times a week with or without the addition of salt or affusions at 68° F. (20° C.). For young and vigorous subjects he advises cool or cold baths of only a few minutes' duration. The temperature should be about 75° F. (23.9° C.), and gradually cooled, according to the state of health of the patient, to 68° F. (20° C.). He employs these cool baths especially during the first weeks of the use of Flechsig's treatment.

Eulenberg recognizes in such measures a wide applicability to raising nutrition and improving the skin, almost never disappointing, especially in bad cases of bromism. He uses the spinal ice-bag when the methods referred to are not permissible.

Matthes,¹ of Jena, takes a very conservative position, making use of hydrotherapy only for a good effect on the skin and an increase of the bodily vigor. This is especially necessary during treatment with bromids and should be adopted so as to obviate as much as possible bromid acne. He uses indifferent baths, that is, at about the body temperature, three times a week, and also the more refreshing procedures, such as the wet sheet tub (*abreibung*) and half-baths. During the attack treatment with ice-caps, stimulating compresses, or diverting methods, such as slapping the feet with cold cloths, are useless. He holds that the action of hydrotherapy in epilepsy, whether for preventing attacks or rendering them less frequent, rests on a very slender foundation.

As we all know, bromids often do harm in the treatment of epilepsy. In any large institution, such as Sonyea, where 2000 cases have been treated and carefully studied, this difficulty is well recognized, and the average dose employed is about

¹ Max Matthes, 'Lehrbuch der klin. Hydrotherapie, Jena, second ed., 1904.

1 gm. daily. At Bielefeld the dose is about 3 gm. daily. In France rather larger doses are given; Féré and Jarnot have used from 12 to 16 gm. daily in special cases.

Among the earlier symptoms are acne and physical depression; later, a decidedly weakened action of the heart, amounting to chronic cardiac asthenia; ptosis of the lids and even inability to walk. In extreme cases, in which the dose is very large or the patient unusually impressed by the drug, there may be disturbances of memory and suicidal or homicidal tendencies. I have seen an epileptic patient in an outburst of passion at a fancied wrong attack a resident physician with great violence. Such cases have been recorded by Echeverria,¹ Weir Mitchell, and others.

We would, therefore, welcome any method that will enable us to use these larger doses with safety to the skin and to the mental equilibrium. Just as warm baths and other hydro-therapeutic procedures undoubtedly enable us to administer potassium iodid in large doses with safety and increased efficacy, so I believe that with the help of baths the bromids will be better borne. Wet packs moderate or prevent bromid acne and help eliminate the bromin and toxins. If followed by affusions of water at 60° F. (15.5° C.) the patient is invigorated.

As to any ill effects from the use of baths, I have knowledge of only two instances in which an attack occurred while bathing. One was in the case of a young man who for nearly a fortnight had been swimming and diving in a large enclosed swimming pool. Although in water beyond his depth, he had his convulsion at the surface and was soon brought by friends to a place of safety. The temperature of the water was about 78° F. (25.6° C.), and there is no reason to believe that the water had any special influence in causing the attack. The second case was that of the unfortunate daughter of the late Mr. Samuel L. Clemens, whose death by drowning in her bath during an epileptic attack was recently reported.

In America attention was first called to the value of hydro-

¹ Manuel Gonzales Echeverria, Amer. Jour. Insanity, 1873-74, vol. xxx.

therapy in epilepsy by Dr. Simon Baruch, and later by the late Dr. G. W. Foster, one of the physicians at the Government Hospital for the Insane at Washington.¹ The measures employed were the drip sheet, wet packs, and douches. By these means bromid acne was either prevented or relieved and the general tone of the patients was improved. The number of attacks in 12 patients was reduced by about 40 per cent. Since this report was issued no further records have been kept, and I am informed that few patients, if any, received any permanent benefit, and this treatment is not now used to any extent in this class of cases.

At the Pennsylvania Epileptic Hospital and Colony Farm the patients receive daily showers and a tepid tub-bath once or twice a week. These are more for hygienic than for therapeutic purposes.

At the Glenmary Sanitarium at Owego, New York, baths are given only for personal cleanliness.

At the Craig Colony for Epileptics at Sonyea, New York, where complete hydrotherapeutic apparatus is installed, systematic treatment is given under the most favorable circumstances, as these patients receive a minimum dose of bromid, about 1 gm. daily, and are under an excellent hygienic régime.

At the Glenwood Sanitarium at Dansville, New York, Dr. J. W. Wherry writes me that some years ago he gave considerable attention to hydrotherapeutic methods in the treatment of epilepsy, but he is not able to say that he noticed any direct effect on the epileptic condition. Since then he has discarded the measure excepting when indicated on general principles without reference to the epileptic condition itself. In a letter to me Dr. Wherry remarks very truly: "Whatever benefits the individual is an aid in the treatment of epilepsy. Some epileptics, like some other people, would be benefited by the employment of hydrotherapy; others would not."

In private practice difficulties are encountered in carrying

¹ Report of the U. S. Government Hospital for the Insane, 1898; also Amer. Jour. Insanity, No. 4, 1899.

on systematic treatment of this description. Daily treatment for several months would be required, and, of course, unbounded patience and hope are demanded of both physician and patient. The usual experience of outdoor clinics is that as patients improve, their visits are more infrequent, but not rarely we find faithful ones who report regularly for years.

We would naturally expect that in focal or traumatic epilepsy less advantage would be derived than in cases of so-called idiopathic epilepsy, alcoholic epilepsy, psychic epilepsy, or in cases arising from intestinal intoxication or obscure metabolic changes. In such cases the free use of water inside and out ought certainly to be given a prominent place in any plan of treatment that may be adopted.¹

HEADACHE

In those cases for which no assignable cause is discovered, hydrotherapy is valuable in its power to divert blood from the central nervous system to the periphery. Various means are employed, the more common being the hot foot-bath or the cold foot-bath, followed by vigorous rubbing. The hot foot-bath may be given with water at 95° to 110° F. (35°-43.3° C.) for from eight to ten minutes. The cold foot-bath, 45° to 55° F. (7.2°-12.8° C.), should be shorter; one to two minutes at first will be sufficient. If flowing water be used the results will be more satisfactory.

If foot-baths are not available, cold compresses to the head may be employed. Vinegar should be added to the band across the forehead, and the compresses changed frequently. Short douches of hot or cold water to the upper spine for a fraction of a minute are also valuable. Colonic irrigations two or three times a week with normal salt solution after an evacuation of the bowels is advised. The Plombières douche or the douches employed at Chatel-Guyon help these cases.

In some severe cases of headache due to brain tumor relief may be afforded by hot mustard foot-baths or other derivative

¹ Schirbach, Jour. Nerv. and Ment. Dis., May, 1907.

hot applications, such as hot spinal compresses or fomentations. The marked relief which follows in some cases of cerebral growth is of some diagnostic value. It is observed that a glioma is more amenable to relief than a sarcoma or gumma.

THE NEURALGIAS

TRIFACIAL AND OCCIPITAL NEURALGIA

Neuralgia of the fifth nerve and occipital neuralgia are benefited by warm baths. It is well known that neuralgias are less severe in dry and warm weather, and this points to the use of hot-air and warm baths in connection with favoring climates. Such cases can no doubt be more successfully treated in Egypt, Sicily, and the Riviera or at the Southern American water-cure establishments. The relation of chronic constipation to neuralgia should not be overlooked, and hence the use of purgative waters like those of Saratoga, Crab Orchard, French Lick (Pluto), Apenta, Hunyadi, Rubinat, and other well-known aperients.

SCIATICA

In sciatica both heat and cold have been employed successfully. Measures of these opposite types are both credited with cures, and in a larger number of cases at least afford much temporary relief. Heat is the better, and is usually sought early in the treatment. Hot fomentations, hot wet packs, warm and hot full baths are the measures most easily employed. The partial vapor bath may be used, allowing the patient to sit so that the heat reaches only to the waist. In this manner a greater degree of heat may be applied to the limbs while the body is not so much affected. This avoids any sense of exhaustion. Temperatures of 110° to 120° F. (43.3°–48.9° C.) or even higher are thus permissible for a period of fifteen minutes. The patient may then be placed in a bath of 95° to 98° F. (35°–36.7° C.) for eight minutes. Toward the end of this time the temperature may be raised to 110° F. (43.3° C.). This process should be repeated daily for several weeks.

The use of the jet douche is valuable. The patient should have the preliminary hot-air bath at 170° F. (76.7° C.) for about six or eight minutes, or until perspiration is established. The jet douche is applied for from thirty seconds to one minute at a temperature of 90° F. (32.2° C.), reduced to 60° F. (15.6° C.), over the spine and to the seat of pain. The Scotch douche at 105° and 60° F. (40.6° and 15.6° C.) is then applied to the spine. The pressure should be from 15 to 20 pounds. This produces great hyperemia of the skin.

It is said that in Berlin during a space of less than three years over 500 cases of sciatica were treated by Brieger in the hydrotherapeutic institution of the university. The Scotch douche is the measure usually employed.

Pospischil recommends an ice-water coil to the lumbar vertebræ, so as to produce a reflex dilatation of the blood-vessels of the lower extremities; combined with this enveloping the painful limbs in bandages (*Longettenverbänden*) renewed several times a day. An ice-bag is applied over the heart, and, finally, soft coverings underneath and above the body. The pack is left in place for from six to eight hours, until sweating has ceased.

The Scotch douche is very commonly used in the German and Austrian clinics. Winternitz has been using this method about sixteen years. It is most successful in recent cases. The contrast douche may be given by means of a hot steaming followed by a cold fan douche. The trunk is then covered with a well-wrung-out moist bandage, over which a dry binder is applied, and the patient is allowed to take active exercise. Winternitz uses this plan in sciatica and in intercostal, lumbar, and brachial neuralgia with success.¹

Nearly fifty years ago, while acting as surgeon in the Civil War in the United States, Dr. Weir Mitchell treated a great many cases of injuries of the nerves from gunshot and other wounds. These injuries were followed by neuralgias, neuritis, and the peculiar burning pain termed by Dr. Mitchell caus-

¹ See Ludwig Schweinburg, *Handbuch der Hydrotherapie*, p. 156.

algia. Cases of sciatica were common. It was found that dry cold by means of ice-bags, if employed for a week or two, was sure to be of service, especially when there was local tenderness of the nerve. Under its use the nerves lost their irritability and shrunk in size; the treatment was kept up night and day. Dr. Mitchell says that when cold cannot be applied he has found moist heat applied to the whole limb, with rest, sufficient.

Ocean baths are usually inadvisable for persons who are liable to sciatica, but swimming in warm pools where the air is warm or artificially heated is often beneficial.

NEURITIS

In cases of **traumatic neuritis** a cold compress or an ice-poultice may be placed over the nerve at the seat of injury, while the distal portion of the limb is wrapped in moist warm flannels. Recently, the use of a saturated solution of magnesium sulphate for the compress, applied at a temperature of 50° to 60° F. (10°-15.6° C.), has been advocated for traumatic and alcoholic neuritis (see pp. 220 and 346).

In **multiple neuritis** and non-traumatic inflammation of individual nerves, warm and hot applications or warm baths usually give relief. If the disease be far advanced, hot fomentations are useful.

The filiform douche and steam douche (dampfdouche apparatus) may be used in cases where counterirritation is desired. The duration of all douches in neuralgia and neuritis should be shorter the higher the pressure.

Much benefit may be derived from the warm douche or "spout" of water, as given at Virginia Hot Springs. This douche has a fixed temperature of 104° F. (40° C.) and a pressure of from 14 to 16 pounds to the square inch. It is followed by a bath in water of the same temperature, lasting from five to ten minutes. After this a hot dry blanket pack for ten to fifteen minutes is given, followed by a cool shower and an alcoholic rub, avoiding pressure on sensitive parts.

Peripheral Neuritis.—The measures described in the treatment of sciatica are suitable in many of the cases. Hot fomentations will relieve pain. After the acute stage has passed the Scotch douche and fan douche should be used to improve the circulation and the tone of the muscles.

PARALYSIS

LOCAL PALSIES

In local palsies from any toxic agent, such as lead, arsenic, mercury, or in those peripheral paralyses due to pressure or other local disturbance, the various forms of hydrotherapy are always of benefit when properly applied. Miners for gold, silver, quicksilver, lead, and arsenic are commonly poisoned. At the mines or at the smelting and refining works, especially where the processes includes the use of mercury amalgam, and where noxious vapors are given off, the employees are liable to a cachexia which demands careful eliminant treatment and tonic measures. In this class, also, may be included alcoholic paralysis.

The wet pack, with water at 65° F. (18.3° C.) for two hours, may be used.

Hot baths, followed by packs and massage, are beneficial. Later, the tonic system of bathing, involving the use of the hot-air or electric cabinet and needle, jet, Scotch, and fan douches, are indicated.

In paralysis from pressure or other peripheral cause, similar measures are indicated, and in these cases, as in toxic paralysis, the earlier hydrotherapy is instituted the better.

PARALYSIS OF ADULTS

In the paralysis of adults, such as posterior and lateral spinal sclerosis, spastic paralysis, and paraplegia, bathing is usually indicated; but in these cases prolonged heating processes, either in the cabinet or in the tub, should be generally avoided. Preliminary heating processes of short duration are necessary, as a rule, before the use of douches, but these need not be in the least debilitating.

LOCOMOTOR ATAXIA

Prolonged warm baths at 95° to 98° F. (29.4°–36.7° C.) may be used in cases of locomotor ataxia and paraplegia. Tabetic patients need a good deal of care and assistance in carrying out these measures. Their station is often bad, and in their naked, unsupported feet they are liable to totter and fall if douches of any force are applied. There should be provision for support for the arms, so as to prevent accidents. All hot pipes, incandescent lamps, coils, etc., should be carefully protected with screens or wire netting.

A good prescription for a case of locomotor ataxia in an early stage is as follows:

Hot-air or electric cabinet bath, eight to ten minutes.

Circular douche, two minutes, 105° to 90° F. (40.6°–32.2° C.), 20 pounds.

Jet douche, one minute, 100° to 85° F. (37.8°–29.4° C.), 15 pounds.

Scotch douche, one-half minute, 105° and 85° F. (40.6° and 29.4° C.), 15 pounds.

Fan douche, twenty seconds, 85° to 80° F. (29.4°–26.7° C.), 15 to 20 pounds.

Alcohol rub. Reduce minima 1 degree daily until fan douche reaches 70° F. (21.1° C.). Increase pressure of jet douche and Scotch douche 1 pound daily until 20 pounds are used, provided the patient bears it well.

In the more advanced stage cold water is not so well borne. At the Montefiore Hospital, New York, in Dr. Baruch's service, the following prescription is frequently used:

Hot-air bath, eight to ten minutes, short of perspiration.

Circular douche, 100° to 105° F. (37.7°–40.5° C.), one minute, 20 pounds.

Fan douche, 105° to 120° F. (40.5°–48.8° C.), gradually and rapidly moved.

Baths of this type improve the circulation and are a valuable tonic measure for all debilitated states in connection with local palsies and paralysis of adults, provided the patient can walk and stand reasonably well.

In prescribing full baths it is not necessary that they contain much gas or mineral ingredients. Hence, long journeys to foreign watering-places are not desirable; neither is it desirable

that tabetics should take much exercise before or after the bath. In general, muscular fatigue should be avoided.

Surf-bathing is not wholly counterindicated in tabes. The author has noted good results in maintaining the general health in such patients, but as the station is usually poor, there must be a very moderate surf, a smooth, hard beach of gradual declivity, and considerable physical strength to make sea-bathing permissible. Excepting in favored localities the water is too cold and the risk of accidents too great to permit of bathing in the open air. The decision must rest with the capabilities of the individual. It has been remarked that the Anglo-Saxon race can enjoy and profit by baths at lower temperatures than other races. There is probably some truth in this, and allowances may be made accordingly.

PARALYSIS OF CENTRAL ORIGIN

Hemiplegia, glossolabiopharyngeal paralysis, acute ascending paralysis, Brown-Séquard paralysis, and syphilitic paralysis are rarely suitable for hydrotherapy unless of the mildest type. Certainly in any acute stage measures of this kind are counter-indicated. In the prodromal stage the circulatory disturbances attending heat-producing baths might hasten an apoplexy, and hence arterial degeneration with high blood-pressure should be met with only the mildest hydrotherapeutic measures. They may be of the type of neutral baths, half-baths, or drip sheets, and their effects should be watched by the attending physician. None of these procedures should be undertaken without first testing the blood-pressure and observing the effect of tentative measures.

In all cases where hypertension exists any extreme of temperature should be avoided. A warm bath should be given daily and at its close a cold affusion to the spine, or an alternate application of hot and cold water to the spine, followed by rubbing.

The only forms of douche advisable are the fan and circular douches; other douches, because of their greater volume, may be too strenuous.

OBESITY

When the increase of fat disturbs the proper function of any organ or, independently of that, becomes a burden, it may be considered a disease.

Hydrotherapy, in connection with systematic exercise in dieting, is used for the reduction of excessive weight with more or less success. There is a type of the overfat, alcoholic, high-living man, who has eaten and drank without very serious effects, and who periodically takes some form of reduction cure in order to keep his weight down and, incidentally, enjoy life once more in his accustomed way. Patients of this type are likely to have dilated stomachs and sluggish livers. They probably have learned to use laxative mineral waters or salts, and in that way obviate any serious illness. Besides a dilated stomach, careful examination will often reveal a dilated or fatty heart, a little tendency to a dusky look about the face, a slightly yellow conjunctiva, a quick pulse, and a tendency to dyspnea. Hydrotherapeutic measures should, therefore, be carefully instituted, and, if possible, the patient should be seen by the physician during and shortly after his first two or three baths.

Men hear a great deal about the "boiling-out" process in use at certain springs. They are impressed with the advantage of extreme measures, and are usually anxious to lose a great deal of flesh in a minimum of time. If they go to a resort, they expect to dispense, more or less, with alcohol, and to limit their dietary. It is remarkable how much weight is lost in a single bath, as shown by careful weighing before and afterward. The author has known a patient to lose 5 pounds in a single bath followed by a hot pack. A patient has stated that he lost 7 pounds in a single bath and pack. The accompanying charts (Figs. 41-44) illustrate the loss of weight in men while bathing, exercising, and dieting. The weight was taken without clothing before entering the bath, and on being dried after the final cold douche.

The régime in Case 1 provided for two meals a day; walking

seven miles; swimming half an hour; a bath consisting of a warm douche for six minutes to the entire body, the water 104° F. (40° C.), and the temperature of the room about 100° F. (37.8° C.); a tub-bath at 104° F. (40° C.) for twenty minutes, followed by a hot pack with eight blankets for twenty-five minutes. After this, the patient got into a tubful of water at 54° to 60° F. (12.2° - 15.6° C.). When he came out he was dried and was ready to rest for an hour. This rather strenuous régime is suitable only for a man in perfect health and of perfect habits, to whom the term "patient" seems wholly inappropriate. The chart shows that in Case 1 as much as 4 pounds were lost in a single bath, and as much as $5\frac{1}{2}$ pounds were gained in twenty-four hours as the result of breaking the dietary régime.¹

In Case 2² the conditions were somewhat different. While accustomed to take a good deal of exercise, there was a decided alcohol habit, greater indulgence at the table, a very slight albuminuria, and a sluggish and overloaded liver. The patient was inclined to break through the régime, but, nevertheless, lost 10 pounds in a month. The bath adopted by patient No. 2 consisted of:

Hot douche, 104° F. (40° C.), ten minutes.
Full bath, 104° F. (40° C.), ten minutes.
Hot blanket pack, twenty minutes.
Cold douche, 50° F. (10° C.).
Alcohol rub.

In the case of a third patient, and decidedly alcoholic, weighing 261 pounds, 20 pounds were lost in twenty-two days. The bath consisted of a warm douche for ten minutes, tub for fifteen minutes at 104° F. (40° C.), and a hot blanket pack, using six blankets. The author has not found the hot-air cabinet followed by circular jet, Scotch, and fan douches, so effective as full baths and packs. Even when the cabinet is used for fifteen or twenty minutes at a temperature above 170° F. (76.7° C.), there is not the same tendency toward the loss of flesh. The following formula is sometimes used in this plan of treatment:

¹ See Figs. 41 and 43.

² See Fig. 44.

Hot-air bath or electric-light cabinet, up to twenty minutes.
 Circular douche, 105° down to 70° F. (40.6-21.1° C.), two minutes, 20 to 30 pounds.
 Jet douche, 100° down to 70° F. (37.8°-21.1° C.), one minute, 20 to 30 pounds.
 Scotch douche, 105° and 70° F. (40.6° and 21.1° C.), 20 seconds, 20 to 30 pounds.
 Fan douche, 65° F. (18.3° C.), ten seconds, 20 to 30 pounds.
 Alcohol rub. Reduce minima 1 degree daily to 60° F. (15.6° C.).

Another prescription is:

Hot-air bath, forty to sixty minutes; soap shampoo.
 Half-bath, temperature of 70° F. (21.1 C.), three to five minutes.
 Jet douche at 70° F. (21.1° C.), twenty seconds; 25 pounds.
 Dress quickly and walk until fatigued.
 Repeat daily and increase duration of hot-air bath, and lower temperature of douche as may be indicated.

Unless the bath given can be shown to have a decided influence on the metabolism, we cannot justly attribute loss of weight to the bathing when used in connection with dieting and exercise. The author believes, as he has already stated, that the hot-air or electric-light cabinet, followed by the various douches in succession, constitutes a method inferior to the full hot bath with subsequent pack. The experiments of Dr. Otto Folin at the McLean Hospital tend to confirm this. Nine persons were given a uniform diet adapted to the capacity of the individual, and containing a known amount of nitrogen. After this diet had been continued for two days, the urine was collected for each twenty-four hours, analyzed, and the result noted. After three or four days, baths were given for about the same period of time, but no particular change was noted:¹

Nitrogen excretion.	Urine in twenty-four hours.	Gain or loss in weight.	Average, four days.
Grams.	Cc.	Grams.	
Case 1 (typical)	61.8	+220	No bath.
	65.1	-220	Baths.
	63.7	+150	No bath.
	62.4	+150	Baths.

¹ For a criticism of this experiment see pp. 36 and 37.

The bathing was about as follows, varying somewhat in special cases:

Hot-air bath, 190° F. (87.8° C.), to perspiration or for five minutes.
 Circular douche, 98° to 90° F. (37.6°–32.2° C.), one minute; 30 pounds.
 Jet douche, 70° F. (21.2° C.), twenty seconds; 30 pounds.
 Scotch douche, 105° F. (40.6° C.), alternating with 70° F. (21.1° C.), one minute; 30 pounds.
 Fan douche, 60° F. (15.6° C.), fifteen to twenty-five seconds; 30 pounds.

The records of 216 cases in which similar baths were given show that 168 gained weight and 48 lost. The gain was from $\frac{3}{4}$ to $33\frac{3}{4}$ pounds; the loss was from $\frac{1}{2}$ to $22\frac{1}{2}$ pounds. It was

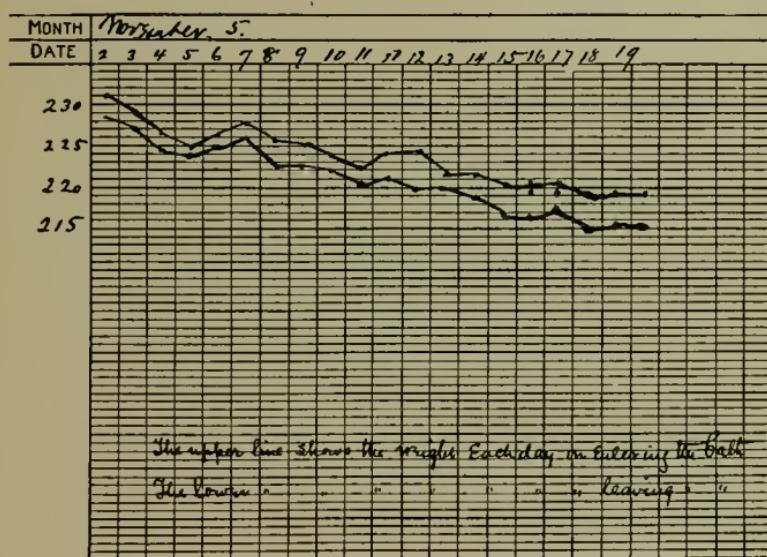


Fig. 41.—The upper line shows the weight each day on entering the bath. The lower line shows the weight each day on leaving the bath. Case 1.

noticed that the gain was usually preceded by an initial loss of a pound or two during the first week of the baths.¹

The plan of treatment depends naturally on the causes of the obesity, and these are usually of a complex character; hence, there is no single remedy for obesity. We naturally use every measure available. Diet, active and passive exercise, and

¹ George T. Tuttle, American Journal of Insanity, October, 1904; see also p. 36.

hydrotherapy should be combined. The object of hydrotherapy should be to provide more oxygen, increase the excretion of carbon dioxid, generate heat, and promote elimination. We have the skin, the bowels, kidneys, and the lungs upon which to work. It is obvious that all measures that stimulate the appetite, invite sleep, and promote constructive metabolism would defeat our ends. The plan which the author usually adopts is, for the first three days, a full bath at 104° F. (40° C.), for twelve, fifteen, or eighteen minutes, according to the strength of the patient. This is followed by a hot dry pack for similar

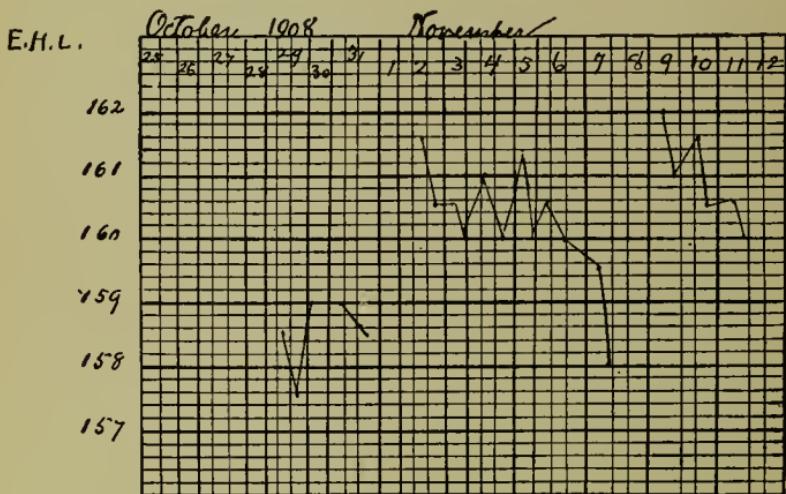


Fig. 42.—On November 1 and 8 bath was omitted, being Sunday, and patient went to luncheon at F. Farm.

periods, a cool spray, and an alcohol rub. The patient is then partly dressed and allowed to rest for twenty minutes. If this treatment be in the morning, he devotes the afternoon to walking, golf, or mountain climbing, as the physical condition of the patient warrants. In the evening he has massage for an hour, or massage may be given before rising. Walks of a 5 and 10 per cent. grade are provided, so that systematic exercise may be prescribed, and it is remarkable what may be done by men and women who are gradually led to take up this form of physical training. The accompanying charts illustrate results obtained

by the author in cases under the combined treatment. (See Figs. 41-44.)

A vigorous and at the same time a rational treatment of obesity in patients presenting no complication of the kidney, stomach, or liver is that employed by Dr. William S. Sadler, of Chicago, and is described in a personal communication to the author:

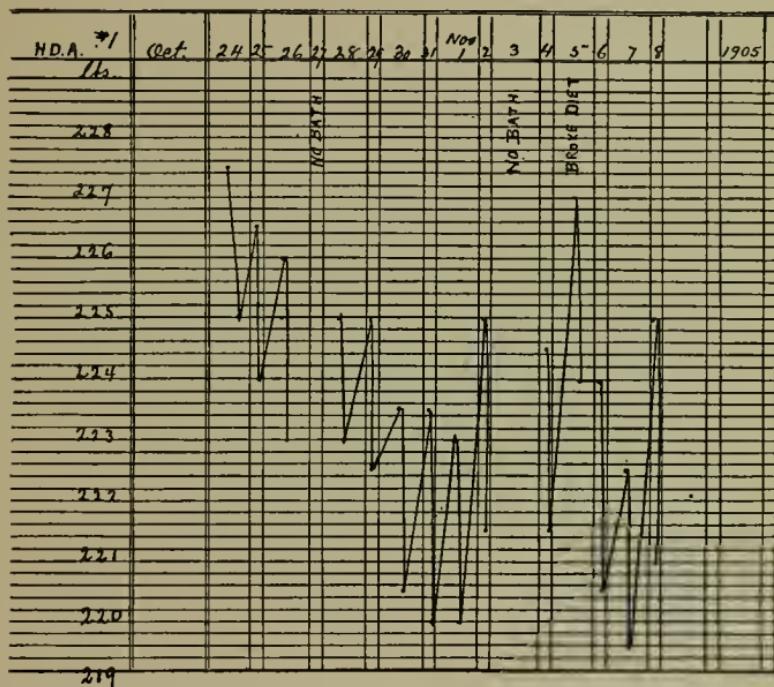


Fig. 43.—The descending line shows the loss of weight during the bath. Case 1.

1. Begin the procedure by short electric-light bath or some other form of sweating. Carry it to just the point of free perspiration.

2. The patient is immediately placed under the cold shower and needle douche. Water is given at the lowest possible temperature and at a maximum pressure (35 to 50 pounds). This treatment is kept up until the patient is thoroughly cold. On coming from this the patient is immediately dried with a sheet and then the next step in the régime begins.

3. Active physical exercise, such as walking up and down in the treatment room, swinging of the arms, taking breathing exercises, bending, etc. A good temperature to have the room in which the obese are to work is from 70° to 75° F. (21.1°–23.9° C.). This exercise is continued until there is a thorough-going reaction and the point of perspiration is again reached, whereupon the patient is again placed under the cold shower-bath and the same performance repeated. This régime is repeatedly

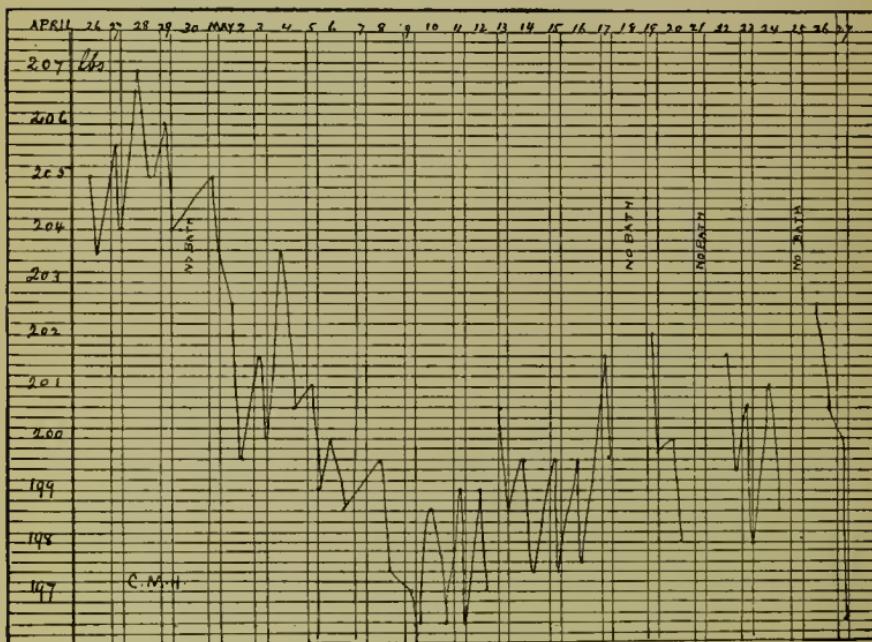


Fig. 44.—The descending line shows the loss of weight during the bath. Case 2.

administered as long as the patient can stand it without any sensations of fatigue or nervous weakness. It is, therefore, best to inaugurate this régime by the graded method until the patient can endure it, but after the first few days the powers of endurance are strengthened and repetitions of the above processes are quite possible.

In robust cases, not in any way debilitated, Dr. Sadler carries out these measures at 10 o'clock in the morning and again at 4 in the afternoon. In his experience it acts much

better than the sweating process, which he thinks weakening. Patients will follow the régime when properly administered and carefully observed, losing in flesh each day, but gaining in muscular strength. It gives the maximum carbohydrate oxydation with minimum proteid metabolism. When fatty degeneration of the heart is present, emphysema, or other complications, modifications of the régime will suggest themselves.

Some cases of obesity, where there is no heart lesion, but where there is a tendency to palpitation on much exertion, are greatly relieved by the application of an ice-bag to the heart at the time the initial heating procedure is taken.

It has been estimated that in a régime such as outlined about a fifth of the units of energy would be represented in work and about four-fifths in heat production, so that any plan combining increased muscular exercise as well as the development of excessive heat production will be followed by a reduction of weight.

Water drinking should be restricted between meals and at night, but may be allowed at the table.¹

EXOPHTHALMIC GOITER

Not a great deal may be expected from hydrotherapy, excepting in the form of local applications. These include cold applications to the thyroid gland by means of ice-bags or the Leiter coil; and ice-bags to the heart or nape of the neck for tachycardia. For the nervousness, warm baths in either fresh or salt water, half-baths, and douches to the spine are advised. Turkish baths, Nauheim baths, and sea-baths are counterindicated.

SYPHILIS

Owing to the success attending the treatment of syphilis at sulphur spas, of which Aix-la-Chapelle is a type, much stress has been laid on the action of the sulphur water externally; but at all spas the waters are used internally as well, and, what is

¹ For a discussion of this subject see Obesity, Carl von Noorden; see also p. 400.

more important, the patients are almost invariably treated energetically with mercurials internally or by inunction or by large doses of iodids. In connection with systematic bathing and massage the medicinal treatment is greatly increased in efficacy.

Undoubtedly, at the spas which have been mentioned the experience of the physicians under whose direction baths are given leads them to judge with unusual certainty of the appropriate amounts of medicines in particular cases. They are enabled to push these to the maximum of tolerance, and in this lies their success. This is recognized by practitioners at Hot Springs, Arkansas, Mount Clemens, and Aix-la-Chapelle, who acknowledge that their results are due to the physical qualities of the baths and not to the chemical ingredients of the water.

W. R. Huggard¹ says: "Formerly sulphur waters were supposed to render mercurial treatment more efficacious or more easily borne—a claim that cannot be substantiated and is now rarely heard." Dr. L. Duncan Bulkley² states that much harm often results from the false security which patients have who have undergone what is called a "cure" at one of these resorts. It has been clearly demonstrated that syphilis cannot be cured by any brief course of treatment, however severe. It is true that the "cures" are distinctly beneficial. This is almost unquestionably due to the active and heroic mercuric treatment to which patients have been subjected, combined with change of air and scene, together with the natural hope and expectation of benefit. Dr. Bulkley does not recall a single instance in which he has regarded it as either beneficial or wise for the patient to undertake this cure (by mineral baths) at any great personal sacrifice. His conclusions are drawn from 20,000 personal dermatologic cases in public and private practice, of which 12 per cent. were syphilis.

¹ Handbook of Climatic Treatment, Including Balneology, London, 1906.

² Medical Record, New York, vol. lxxii, No. 6, 1907.

Regime at Aix-la-Chapelle.—It may not be out of place to refer to the régime which patients follow at Aix-la-Chapelle and Hot Springs, Arkansas, from which it will be seen that the medical treatment is accorded its proper place, the physicians recognizing that the thermal springs are no more able than any other medicinal waters to cure syphilis. Their value depends on the fact that they facilitate the use of mercury—the only real specific competent to eradicate the virus and to exercise a favorable influence at all stages of the disease. It is particularly desirable to concentrate as much treatment as possible into the first few years, or even months, for only in this way can the development of the tertiary stage be avoided.

Mercurial inunction is to be preferred to administration per os as producing a more energetic result and being free from the risk of intestinal complications. It is this method which is almost exclusively employed at Aix, and it is claimed to have more permanent effects than those obtained through other channels of administration. To secure a satisfactory absorption of the remedy it is necessary that the skin be properly prepared. This is accomplished by means of the thermal baths, which soften the epidermis and dilate the orifices of the glands. The inunction is performed by a certificated “frotteur,” who massages the prescribed quantity of the ointment into the skin. It is believed that the mercury is distributed through the body as an albuminate. As douche-massages, thermal, vapor, and electric baths increase the amount excreted in the urine, these are employed with a view to quicken the metabolic processes, in which, of course, mercury plays its appropriate part.

To avoid any risk of *stomatitis*, disinfection of the mouth with dentifrices and mouth-washes is practised. Every morning the patient drinks two or three glasses of spring water, to which, if there is sluggishness of the bowels, a teaspoonful of Aix-la-Chapelle salts is added. This is followed by a thermal bath. The portion of the surface that is to be the site of the next rubbing is then thoroughly cleansed with soap and water,

and care is taken to avoid the use of soap or of friction by the towel over parts which have previously been subjected to inunction. Occasionally a vapor bath or douche-massage precedes the ordinary thermal bath. Next, the patient is instructed to rest in bed, and about an hour after breakfast the inunction is performed. The ointment used is a 33 per cent. unguis hydrargyri. It is applied on different parts according to a regular daily sequence—legs, thighs, back, abdomen, iliac regions, and arms. Before the midday meal another glass of spring water is taken with a view to promote appetite. After every meal the patient uses a salol and chlorate of potassium tooth paste, and, in addition, he employs every half-hour a solution of aluminium acetico-tartaricum as a mouth-wash.

The *diet* during the whole of the treatment should be as supporting as possible. Milk should be taken freely. Red wine with seltzer-water may be permitted with meals. Smoking, especially during the secondary period, is apt to provoke mucous plaques in the mouth and throat.

Frequent observation is made of the urine, and the development of albuminuria demands a pause in the treatment.

The above are the details of an ordinary course of inunction. In particular circumstances supplementary measures may be necessary. Thus, any signs of *gummatous development* call for potassium iodid, which is given in doses of 75 to 100 gr., dissolved in milk or soda-water. When the gumma subsides, iodid is no longer necessary, but, to be on the safe side, injections of 25 per cent. iodipin (iodized sesanee oil, Merck) may be given. This insures a protracted action, as it is found that even six months after the injection of 200 gr. of iodipin the urine still gives a definite iodin reaction. Iodipin further appears to increase the tolerance for the mercurial inunction, and this is continued simultaneously.

Another supplementary remedy is sarsaparilla. This is indicated where former excessive mercurial treatment has so influenced the tissues that a prompt response to the inunction is not obtained.

Sulphur Waters.—In a recent paper by Dr. Jean Dardel,¹ of Paris, great stress is laid on the use of sulphur waters in syphilis. These are used under his direction at Aix-les-Bains. The sulphurous calcic waters, having a temperature of 113° F. (45° C.), are used externally in the "Aix douche" (see p. 263); in the form of vapor baths; and internally, for which the Marlioz water is specially employed. The waters of Marlioz are brought from a neighboring spring. It is the most sulphurous of the three springs which occur in that locality, and has a temperature of 57.2° F. (14° C.). It is easily borne by the stomach and is considered eminently suitable for the internal sulphur cure.

It is claimed that used internally sulphur waters have a general tonic and exciting action. Dardel states, however, that in his opinion this stimulant action depends more on the mode of treatment than on the waters themselves, and that the thermal fever which has been described by certain authors is due to a too energetic and rapidly applied treatment. The cure has a favorable action on all the organs. The appetite is stimulated, the red corpuscles are increased in number, the urine is more abundant, and the quantity of urea eliminated is more considerable. Nutrition which is retarded by the direct action of syphilis is stimulated and activated by the use of sulphur waters.

Dardel takes a very sensible view of the matter when he says that the treatment of syphilis by the use of sulphur does not cure alone, but forms a very valuable auxiliary treatment, which may be combined with a course of mercurial treatment; also that the water will help greatly in the absorption, action, and elimination of the drug. The cure is indicated at any period of the disease, since nutrition suffers at all stages.

Counterindications and Indications.—Patients suffering from arteriosclerosis or liver trouble, and those who are highly nervous, should not undergo an active sulphur cure. It is especially indicated in those who take mercury badly, or who can tolerate but a small dose of it, and in those in whom the therapeutic action of mercury is not easily obtained. It is also indicated in

¹ Medical Record, New York, July 20, 1907.

cases of great destruction of tissue, or severe infections in feeble or worn-out patients, and in lesions of the nervous system, ulcerative lesions that threaten great destruction to the organs affected, and such other lesions in which prompt treatment is demanded. The treatment strengthens the patient and increases his tolerance for mercury. The sulphur of the water is converted into alkaline sulphids, some of which are oxidized into hypo-sulphites and sulphites; but the most of the sulphur forms hydrogen sulphid, which is eliminated by the lungs and skin. The water has a general tonic and exciting action, and liberates mercurial compounds stored up in the system.

The **Hot Springs of Arkansas**, all the bathing establishments of which are on United States Government property (see p. 19), are largely used for the treatment of syphilitic affections.

It is usual at first to order a bath of six minutes' duration at a temperature of 93° to 95° F. (33.9°–35° C.), to be gradually increased in successive baths to 100° F. (37.8° C.), for ten minutes. After the tub-bath, packs in hot blankets, employing two, three, four, or five blankets. Alcohol rubbing is not used, as it is believed to prevent elimination through the skin. Cold douches are not usually given either, although cold cloths may be applied to the head if there be a tendency to headache.

Vapor baths may be medicated with either calomel or sulphur. In treating early syphilis, especially when there are extensive eruptions, 15 to 30 gr. of calomel may be volatilized by means of special apparatus, with just sufficient water to excite the skin to moderate action. Preliminary steaming is not necessary, as the heat required to volatilize the calomel is enough to excite sufficient perspiration. For sulphur vapor baths, 1 or 2 ounces of sublimed sulphur may be used. Patients with syphilis, rheumatism, and acne may be benefited by such treatment.

In **iridocyclitis**, with synechiaæ and vitreous opacities due to syphilis, hot baths and sweating processes, such as hot packs, should be used in connection with specific and local treatment to the eyes.

Cutaneous Manifestations.—It has been noted that baths are liable to induce cutaneous manifestations in syphilis, especially when given before the secondary stage. They sometimes reveal a latent syphilis and in this way favor a positive diagnosis. As a general measure a weekly Turkish bath is commonly advised in the routine treatment of syphilis. The author thinks this a reprehensible practice unless the management of the public Turkish bath establishment be informed as to the nature of the disease and suitable provision be made to avoid the danger of transmission of the disease to attendants and the patrons of the baths. At certain resorts which cater to this class of patients such provision is made, and the attendants who give inunctions and baths for syphilis are both cautious and efficient, and hence carry out these measures far better than these when left to the patient himself.

SKIN DISEASES

Mineral waters have always had a reputation for the cure of skin diseases. Few advertisements of mineral springs fail to mention their efficacy in such cases. There must be some foundation for this belief, which has existed from time immemorial. To relieve fecal accumulation is the first step in the treatment of inflammatory diseases such as eczema and acne. It is necessary in many cases, therefore, to eliminate the true causes of these afflictions by administering the purgative waters such as Saratoga Congress Water, Crab Orchard, Abilene, Hunjadi, Fried-richshall, Pullna, or Pluto.

Skin diseases may require variously modified baths. The following may be used in 30 gallons of water at a temperature of 100° to 104° F. (37.8°–40° C.):

Emollient Baths.—Bran, 2 to 6 pounds, to 30 gallons of water; potato starch, 1 pound; gelatin, 1 to 3 pounds; linseed, 1 pound. These are useful in erythematous, itchy, and scaly diseases, as for example, psoriasis.

Alkaline Baths.—Bicarbonate of soda, 3ij to x; carbonate of potash, 3ij to vj; borax, 3iiij. The bicarbonate may be used

with bran liquor, made by infusing a gallon of bran. Useful in eczema, psoriasis, urticaria, lichen, and prurigo, where there is much local irritation.

Potassium sulphid, ʒij to iv to each bath. Another formula useful in itch, chronic eczema, lichen, and psoriasis is:

Precipitated sulphur, ʒij; sodium hypophosphite, ʒj; dilute sulphuric acid, ʒss, mixed in a pint of water and added to the 30 gallons of the bath.

Ichthyol baths, in the strength of ʒvij to x (250–300 gm.) to 40 gallons, have been used by Dubois in cases of pruritus, pityriasis, psoriasis, eczema, and scabies.

Simple vapor and hot-air Turkish baths are not specially valuable in skin diseases. They are, as a rule, injurious in eczema, which forms the largest class of diseases of the skin.

Precautions.—Naturally, in treating contagious skin diseases, precautions must be taken that the tubs and other utensils used in the bath, as well as the hands of the operator, be absolutely disinfected afterward. It would be nothing less than criminal to neglect these precautions. Patients suffering from syphilis, leprosy, scabies, tinea, and the less communicable skin diseases should never be bathed in tubs to be used by others. In resorts like Mount Clemens, Michigan, and Hot Springs, Arkansas, special porcelain tubs are assigned to syphilitic cases. When cases are treated in hotels, boarding-houses, sanitaria, and hospitals the physician should hold himself in honor bound to see that no contagion can possibly be left when it becomes necessary to bathe any case of this type.

PSORIASIS

Arsenical Waters.—In the more refractory skin diseases, such as psoriasis, the internal use of arsenical waters, such as those of Royat, La Bourboule, Roncegno, and Levico, are useful. The latter is the strongest arsenical water known, containing about $\frac{1}{12}$ gr. per pint, as well as persulphate of iron. Not more than a tablespoonful is usually prescribed, or about $\frac{3}{8}$ gr. of arsenous acid. La Bourboule contains about 2 gr. of sodium

arsenate in the gallon (0.028 to 1000 ee.). The Royat Spring is richer in iron than La Bourboule, but contains only one-sixth the amount of sodium arsenate, or about $\frac{1}{2}$ gr. per gallon.

Sulphur waters have been successfully used in treating psoriasis. They are usually applied externally. Those best adapted for this purpose in America are Richfield Springs, Sharon Springs, in New York, White Sulphur Springs, in West Virginia. In England those of Harrogate and Strathpeffer, in Great Britain; Aix-la-Chapelle, Germany; Schinzerach, Switzerland; and Bareges, in the Pyrenees in France.

Thermal baths in weak alkaline water are also used. Those of the Warm, Hot, and Healing Springs in Virginia and of Hot Springs in Arkansas belong to this class. Corresponding baths are found at Bath and Buxton, England; at Leuk, Switzerland, altitude 4500 feet, Canton of Valois; at Aix-les-Bains, France. The latter springs have a temperature of 112° to 116° F. (44.4°-46.7° C.). The waters of Plombières, in the Vosges Mountains in France, are used in cases of psoriasis as well as pemphigus. They are applied in a continuous bath, the natural temperature of 117° F. (47.2° C.) being moderated. The altitude of Plombières is 1310 feet and the climate is bracing. At Baden, near Vienna, and at the Sulphur Springs of Leuk, Switzerland, excellent results are obtained.

The **wet pack** is useful in extensive psoriasis to remove scales and diminish hyperemia. Notwithstanding a great many testimonials regarding the efficiency of mineral springs in the treatment of psoriasis and a rather widespread faith among members of the medical profession in the use of baths in this disease, some of the most distinguished dermatologists are not so sanguine. Dr. L. D. Bulkley,¹ of New York, in a recent article on the treatment of psoriasis, does not mention baths at all, and does not believe that they are of any special use in this affection. This was somewhat surprising to the writer, but correspondence showed that this position was the result of large experience. However, the author would suggest that while

¹ Journal of the American Medical Association, Nov. 17, 1906.

cures may not be expected from hydrotherapy or mineral baths at resorts, owing to the chronic nature of the disease, nevertheless some benefit may accrue, just as in cases of syphilis, and that subsequent measures, such as prolonged and rigid vegetable diet and the use of ointments, may accomplish the actual cure.

LEPROSY

Fortunately, this disease is so rare in America and in Europe that its treatment is practically unknown except in the leper colonies. The discovery of a case in the United States throws the community into a panic, and the health authorities are more concerned with getting rid of him than in treating him.

The author has had no personal experience with this disease, but the following plan of treatment has been found to relieve the neuritic pains from which many lepers suffer:

Medicated Baths.¹—Patients suffering from ulcerated tubercles or thickened skin or in whom there is neuritis or lymphadenitis derive benefit from these baths. The medicated baths used are the alkaline, sodium bicarbonate or borax, 1 pound to the bath; astringent, alum, $\frac{1}{2}$ pound to the bath; potassium sulphate, $\frac{1}{2}$ pound to the bath. The one which has proved most beneficial is a warm or hot medicated bath, made by adding to the water (30 to 40 gallons) an infusion of eucalyptus leaves (4 gallons).

The bath should be given twice daily, the water of the *morning bath* being at a temperature of from 95° to 104° F. (35°–40° C.). Enough water should be used to immerse the body (30 to 40 gallons). The patient should remain in the bath at least fifteen minutes, and during the immersion active friction should be kept up on all parts of the body. Immediately after bathing the patient should be thoroughly rubbed with a towel coarse enough to cause exercise to the skin. This should be followed with an ointment composed of:

¹ Hollman, Journal American Medical Association, 1906, p. 1815.

Olei eucalypti,	
Ung. sulphuris.....	āā 5 iv (15)
Lanolini.....	3 ij (60).—M.
Ft. ungt.	

This ointment should be thoroughly rubbed into the skin, removing all excess.

The *evening bath* should be at a temperature of 105° F. (40.6° C.), and should be gradually raised as high as can be safely borne, about 110° F. (43.3° C.). After this hot bath the patient should be wrapped in a warm blanket and allowed to remain thus covered for ten minutes. This causes the sweat glands to act freely, thus removing waste material from an already diseased body. The rubbing with a coarse towel and the use of the ointment should then follow. This hot eucalyptus bath assures the patient a good night's sleep, a thing most highly valued by a leper suffering from neuritic pains.

Combination Treatment.—Dr. Matias Duque,¹ of Havana, has recently reported cures in leprosy from a combination of various measures in which baths have a distinct place. In the first period of the disease cases are cured in eight, ten, or twelve months; in the second period 60 per cent. of the patients are cured in two to five years. But in the third period, when all the organs are affected, there is no cure. Internally he gives an extract of the red mangrove or mangle. The bark is extracted with alcohol and preserved in glycerin; this is also added to the baths.

As to baths, he says: "The immersion bath should cover the entire body, and should be taken on going to bed, at a temperature from 102.2° to 104° F. (39°–40° C.), or as the patient may be able to endure it. The duration of the bath should be from fifteen to twenty minutes, and care should be taken that the temperature be always the same, that the body be immediately wiped or thoroughly dried without rubbing or friction whatsoever, and the patient be at once put to bed well wrapped. The bath is more efficacious if a decoction of the mangle (mangrove)

¹ American Journal of Dermatology, December, 1907.

be made in sufficient quantity to redden the water used in said bath."

The baths undoubtedly improve the circulation, stimulate the sweat glands, and soften the skin.

ECZEMA

Continuous Bath.—In 1877 Ferdinand von Hebra introduced the continuous bath as a cure for chronic eczema and other chronic squamous diseases. In general it has not been considered wise to apply water in eczema, but when the affection is generally distributed over the body and of a chronic type, the continuous bath softens the skin, hastens desquamation, and moderates or entirely relieves the excessive itching. In subacute cases a cool bath in which some borax or sodium bicarbonate has been dissolved affords comfort. The addition of flaxseed, cornmeal, or bran to the baths softens the skin and prepares it for ointments if these be required.

PARASITIC SKIN DISEASES

In parasitic skin diseases, such as *tinea versicolor* or *disseminated scabies*, baths are very useful in improving the skin's tone. Disseminated itch is very common in France and Austria, and it is customary at the large clinics to order a full hot bath with green soap, after which Wilkinson's ointment or Hebra's modification is used.

At University College, London, they use sulphur baths. The patient is soaked for fifteen minutes in a solution of 4 ounces of sulphid of potassium to 30 gallons of water, and is then scrubbed with a stiff brush and again placed in the bath for fifteen minutes, after which he is allowed to dress, his clothes having been baked in the meantime. One or two such baths are enough, but, as a rule, three are ordered.

In the Vienna clinics the patients with scabies are turned over to the "diener," who orders them to strip and then gives them a jar of Hebra's modification of Wilkinson's ointment, composed of sulphur flowers, 15 per cent.; oleum rusci, 15 per

cent.; green soap, 30 per cent.; prepared chalk, 10 per cent.; lard, 30 per cent. The "diener" sees that this is rubbed all over the body from the neck down. They are then allowed to dress and are instructed not to bathe, and to rub the ointment on once a day until the skin begins to desquamate, which takes four or five days. They are then allowed to bathe, and when the skin has all desquamated, which will be four or five days longer, they are cured.

FURUNCULOSIS AND PEMPHIGUS

These affections have lately been successfully treated by means of hot baths and hot dry packs, followed by an immersion bath of 1 : 10,000 of the solution of mercuric chlorid.

The method depends upon the ability to dislodge the staphylococci from the horny layer of the skin, where they start the abscesses. This is accomplished by the vigorous sweating and the action of the bichlorid. The procedure was instituted by Lewandowiski and adopted on a large scale by Reiche, who applied it chiefly in the case of children.¹

Hot wet packs and affusions are useful in these diseases.

HYDROTHERAPY IN SURGICAL AFFECTIONS

Germany and Austria are far in advance of England or America in the systematic use of hydrotherapy. In the Hydrotherapeutic Institute of the University of Berlin thousands of patients have been treated yearly since its opening in January, 1901; 100 skilled attendants are employed and hundreds of physicians from Germany and other countries have been educated in hydrotherapeutic methods. In the Royal Wilhelms Heilanstalt, in Wiesbaden, about 4000 surgical cases were treated in 1903 and 1904. In a single year over 40,000 baths were given to all classes of patients. The chief ailments treated were chronic articular rheumatism, bruises, sprains, fractures, dislocations, and wounds.

¹ Therap. Monatshefte, May, 1909, xxiii, No. 5, Jour. Amer. Med. Assoc., June 12, 1909.

Thermal baths were most commonly used; partial thermal baths, thermal douches, and fango treatment were also frequently employed; cold douches and steam douches were used less frequently. Hydrotherapy is used in connection with massage and the Zander apparatus.

The waters employed abroad are usually only a little above the body temperature. Mineral steam baths, baths or douches in mineral water or of gaseous waters are used, and always in connection with the internal use of some of the springs. The



Fig. 45.—Diagram to show the effects of heat and cold in lessening the pain of inflammation. The diagram represents the end of the finger, a star indicating the point of irritation. The line in the center of each figure represents the sensory nerve, on either side of which are drawn the artery and vein, joining in a capillary network at the tip. At *a* the capillary network around the seat of inflammation is seen to be much congested; the nerve filaments are thus pressed upon and pain is felt; *b* represents the condition of the finger after the application of cold to the arm or hand. In consequence of the contraction of the afferent arteries the finger becomes anemic, no pressure is exerted on the nerve filaments, and pain is relieved; *c* represents the finger after it has been encased in a warm poultice; the capillary network at the surface of the finger is dilated and the blood is thus drawn away from the seat of irritation, and pain, therefore, is relieved (Sir Lauder Brunton).

greater heat capacity of mineral mud and sand baths favors their use.

Many surgical affections respond to hydrotherapy locally and generally applied. The general tonic and hygienic influence of bathing, the improved condition of the blood, and the circulation and consequent increased oxidation are the prime factors.

Relative Effect of Heat and of Cold in Local Inflammation.—In choosing heat or cold, one should take account of the character of the tissues which are inflamed. If these are soft

and yielding, the use of heat is more likely to give relief than if the inflammation is seated in or under more unyielding structures. It is well known that pain at the root of a tooth or under hard fascia is best relieved by heat. In his lectures on the therapeutics of the circulation in the physiologic laboratory of the University of London, Sir Lauder Brunton showed this well by means of the accompanying diagram (Fig. 45).

DISEASES OF THE BONES AND JOINTS

Acute diseases of the bones and joints are, generally speaking, poor subjects for hydrotherapy. In all these affections a chronic process follows the acute stage; but treatment in this manner affords the best results.

An **acute infectious osteomyelitis**, in which the growing skeleton and all its parts are affected, affords a conspicuous example. Pus infiltrates the bones, causing necrosis, and baths may accomplish great good. Stiffened joints resume their former mobility; the atrophied muscles are afforded a better circulation and strength returns as formerly; but, more than this, hydrotherapy favors the separation of dead bone from the surrounding healthy tissues. For such cases warm baths of long duration for several weeks are required.

In **tuberculosis** of the bones and joints preëminence is naturally given to the influence of climate. Especially favorable are marine climates and second only to salt or mud baths containing iodin and bromin. Dr. Fedor Krause, of Berlin, who has given a great deal of attention to this subject, attributes to such baths a direct influence on bone tuberculosis.¹

SPRAINS

One of the commonest surgical affections for which hydrotherapy is applied is a sprain of the ankle. Both hot and cold applications yield good results, and either may be chosen, depending upon which is the most convenient and which will prove more

¹ Berliner Klin. Woch., Nov. 14, 1905.

grateful to the patient. The author has usually employed hot water in acute cases. The swelling and hyperemia are controlled by either hot or cold, aided further by the application of firm and systematic pressure and massage.

Hot Applications.—When seen shortly after the injury or, better, before the physician has arrived, the injured foot should be placed in a foot-tub partly filled with water at about 103° or 104° F. (39.4° or 40° C.). This will be sufficiently hot for most patients, particularly for children and men; hotter water may be added cautiously until a temperature of 110° or 112° F. (43.3° or 44.4° C.) is reached. Some patients can stand higher temperature, but extreme heat is not necessary. Water should be added as the bath loses heat; the ankle and foot may be rubbed or stroked while in the water. After ten, twelve, or fifteen minutes the limb is rubbed dry and then gently massaged or rubbed with a little soap liniment. A good dressing for the next twelve or twenty-four hours consists of a long face towel of linen folded in its long diameter and rolled like a bandage. This is dipped in water at about 120° F. (48.9° C.) and applied like a roller bandage. This bandage may be enveloped in a dry bath or Turkish towel and the patient made comfortable in bed. If the pain persist, applications of water at 110° F. (43.3° C.) may be made to the towel first applied. If the patient be not in bed, the foot should be elevated. After twelve or twenty-four hours the dressing should be removed and a stimulant liniment or the milder soap liniment applied, and the massage repeated.

Surgeons are inclined to apply the plaster-of-Paris dressing at this stage or the adhesive straps advocated by Gibney, Littlejohn, and H. G. Johnson.¹ The latter uses an ice-bag three out of four hours, applied over the part, the limb having been previously dressed with adhesive strips and an enveloping gauze bandage. After forty-eight hours it may be possible and desirable for the patient to take a few steps. Each case has to be treated in accordance with the character of the injury, but the author believes that the greatest dangers are in attempting to

¹ New York Medical Journal, May 19, 1906.

use the limb too soon and, on the other hand, employing methods that immobilize the joint and prolong the period of disability.

Cold Applications.—When cold water is chosen at the start, or when the accident occurs in field or in camp, the foot should be placed in a running stream and vigorous friction applied. In foot-ball practice cold water is the panacea, and it is remarkable what restorative effects it produces while "time is called" or "between halves" or quarters in all sorts of minor accidents incident to the game (see p. 215).

Cold may be applied to sprains and bruises by means of cloths wrung out of ice-water, by ice-bags, and by "ice rubs."

Dry Heat.—In acute and chronic sprains and in tenosynovitis great comfort and benefit are derived from applications of dry heat. In general, it may be said that under the action of heat the parts enlarge by reason of the access of blood; but owing to the acceleration of the circulation the absorption of exudates is favored.

Influence of Osmotic Pressure.—Some stress is laid by German writers on the influence of the osmotic pressure on the size of the cells. It is claimed¹ that when the osmotic pressure is high, the cells of the region are injured and swell, resulting in pain and inflammation. The application of hot or cold water bandages to induce *reactive hyperemia*, among other things affects the conditions of the osmotic pressure, increasing the centrifugal movement of the lymph, and with it sweeping the products of inflammation toward the periphery, where they are likely to be taken up by the blood or otherwise rendered innocuous. Superficial edema with deep-seated inflammation should be regarded as an indication for inducing this reactive hyperemia, and this indication can be met by applying a Priessnitz bandage. It is also indicated when the edema is still latent, for the effect is far reaching.

¹ H. Schade, Action of Hot or Cold Water Bandages in Inflammation, Münchener Medizinischer Woch., liv, 1907, No. 18, pp. 865-920.

FELONS, FURUNCLES, AND PHLEGMONS

Local hot baths are used in Germany and Austria for these injuries. These baths are maintained at as high a temperature as can be borne for half an hour to an hour and repeated several times a day. Sometimes a little carbonate of soda ($\frac{1}{2}$ tablespoonful to 1 quart) is added. Undoubtedly these measures hasten the natural processes of repair and are analogous to the methods of passive hyperemia advocated by Bier.

SURGICAL SHOCK

Heat is usually required in shock. Whenever the bodily temperature falls below normal and collapse threatens, hot applications should be made. If there are no dressings or other injuries to interfere, apply hot packs or give hot baths. The mere wrapping of the body in blankets when the animal temperature has fallen will not suffice. The hot bath, according to H. C. Wood, is the only pyretic remedy that can be relied upon. It should always be a full bath, in as warm a room as can be procured, and should be at a temperature of about 104° F. (40° C.).

The duration of the bath varies with circumstances, but it should not be less than half an hour unless the mouth temperature becomes normal in less time. During the bath the heat of the water should steadily be increased as rapidly as it can be borne if the patient be conscious; if he be unconscious, until a temperature of 108° F. (42.2° C.) be reached.

Heat During and After Operations.—In applying heat during or after surgical operations it is possible to produce a condition similar to insolation. In a recent case of abdominal section for fibroid tumor, notwithstanding the great heat of the day, the thermometer in the operating room registering 94° and 95° F. (34.4° and 35° C.), hot-water bottles were liberally used in preparing the bed and were also placed about the patient. The temperature of the patient rose to 108° F. (42.2° C.) before the artificial heat was removed. Although an ice-cap was im-

mediately placed on the head and the patient sponged with alcohol, the patient died in twenty-seven hours, probably from the overuse of heat.¹

FOOTBALL INJURIES

These are not so common or so serious since new rules were adopted in 1906, with the important modifications agreed upon in 1910. They are frequent enough, however, to require the presence of surgeons, both in practice and in match games in the larger colleges. The commonest accident is *concussion of the brain*; or, at least, this was the commonest accident under the old rules when "mass plays" were in vogue. Now, in the experience, at least, of the Harvard football squad, *dislocation* of the acromial end of the clavicle is the most frequent. *Poops* are also not infrequent, as well as contusions, sprains, and dislocations. Buckets of cold water are kept at hand to dash in the face of men receiving concussions and for use in cases of contusions and sprains.

Poops, by which are meant ruptures of one or more of the anterior thigh muscles, are very painful, and in some cases are followed by an effusion into the knee-joint and by synovitis.

The best treatment is a long-continued soak in hot water by means of the full bath or hot compress to the entire limb. Absolute rest is necessary and in the early stages massage should be wholly avoided.

In *synovitis of the knee-joint* a long hot soak, or long and repeated fomentations or hot compresses should be used. These are followed by a heavy bandage to produce compression. This is repeated at bedtime, the knee soaked again, and the bandage reapplied.

BURNS AND SCALDS

Continuous Bath.—One of the latest and most successful methods of treating extensive burns is by means of the continuous bath. The patient is immersed in a tub of water at 98° F. (36.7° C.) and a constant temperature maintained. He

¹ Jour. Amer. Med. Assoc., March 13, 1909.

is taken out every day for the removal of sloughs, but is replaced in the bath until all sloughing has ceased. The water is changed several times in the twenty-four hours; it is comfortable for the patient and obviates the disagreeable odor so objectionable in these cases.

In European hospitals this method is used much more extensively than in America, but some of our institutions are now provided with facilities for the continuous bath.

Dr. Achilles Rose has brought this bath to the notice of the medical profession in America and gives the following account of it:

"Sept. 14, 1857, a fire broke out in the pyrotechnical laboratory in Frankfort-on-the-Main. Of 20 persons burnt, 7 had perished in the flames or died from inhaling obnoxious gases. Among the 13 remaining who were taken to the hospital different degrees of combustion presented themselves. All these cases were treated by Dr. G. Passavant and all except those with burns on the head alone were given the continuous warm bath—according to the extent of the injury—the partial, or the full bath. This is the first record I can find in literature of treatment of burns by the continuous warm water bath.

"We see Passavant has treated extensive burns with the continuous bath in the year 1857 (his first publication of the method appeared in the year 1858), but Hebra writes in the *Allgemeine Wiener Medizinische Zeitung*, 1861, No. 43: 'The continuous full bath given for therapeutic purposes and kept up for days, weeks, and months has, as far as I am aware, never been tried or carried out by any one.' He says he has made use of this method in three cases during the year 1860. His experience in the treatment of such injuries by means of ointments and caustics had been most unsatisfactory, and these sad experiences gave him the idea to make use of the continuous warm bath in case of extensive burns. He does not mention Passavant, whose article appeared in the best-known German medical journal of that period, namely, the *Deutsche Clinic*, 1858, Nos. 36, 38, and 39. In the text-books—and I have examined a great many—Passavant is not spoken of

either, but all credit of having introduced the method is given to Hebra.

"Passavant says that he had already had good results before the year 1857 by using these baths in cases of combustion, and that he had been induced to utilize them in such cases on account of the analogy between the wounds of combustion and other wounds in which he had found the bath effective, and finally because he considered that the drawbacks attached to other methods of treatment of burns could be avoided by employing the continuous warm water bath. The injured, even those who had sustained extensive burns, suffered at first comparatively little, but after a while, most violent pain. The action of the continuous bath is manifold. It gives almost immediate and even complete relief from such pain and can be considered as the most excellent anodyne. Even if it offered no other advantages it would be of great value on account of this soothing effect when the pains are most excruciating. Another advantage of the warm water treatment is that the water penetrates the burnt tissues, in consequence of which they remain moist and soft. Without the immersion the cuticle which has been destroyed in its whole depth would harden and form an impenetrable cover over the underlying parts. Immersed in water, tissues which have become gangrenous cannot dry up, but remain moist. They detach themselves easily and are washed away after having become detached. Thus the wound is constantly kept clean. There is no accumulation of pus, no crusts of desiccated wound secretion, and, which is most essential, no dressing is required. The patient has not to suffer the often painful procedure of change of dressing. Langenbeck, who in the year 1850 introduced continuous immersion as a method of treating surgical wounds, characterized it as the mildest method, not requiring dressing, securing clean wounds in a way which could not be surpassed by any other method.

"Concerning further and most essential advantages of the continuous warm bath in case of burns we have to study the physiologic action of the warm bath on circulation and innervation in general. There are certainly many cases which would prove

fatal without the advantage of this means, while with the aid of the continuous warm bath they make a good recovery. We know the serious effect of extensive burns on the nervous system, and here the continuous warm bath must be considered as the best of all remedies.

"When a part of the body is placed in warm water, the nerve ends of the skin become irritated. This irritation is transmitted to the vasoconstrictor nerves and is followed by dilatation of the blood-vessels, and consequently by acceleration of the circulation. This accelerated blood circulation facilitates the elimination of the products of inflammation and infection, and with the removal of pyrogen substances and toxins through the general circulation, fever will be reduced. The warm baths are a means to stimulate metabolism, the principal desideratum when we have to deal with severe injuries needing great recuperative power."

Roller Bandage.—Winternitz has long advocated the use of roller bandages, wrung out of cold water, in the treatment of burns and ulcerative processes. The stimulus from the cold, the steaming, and the reactive fluxion induce an artificial hyperemia, as in Bier's technic.

ERYSIPelas AND IVY-POISONING

These are successfully treated by a concentrated ice-cold solution of magnesium sulphate applied to the affected part, and kept moist day and night. An ice-cap to the head and general sponging with tepid water should be used when the temperature rises above 100° F. (37.8° C.).

Facial erysipelas may be treated also by compresses wet with a solution of magnesium sulphate and applied at a temperature of 50° to 60° F. (10°–15.6° C.) (see p. 220).

BED-SORES

These are occasionally extensive and serious complications of spinal injuries, myelitis, and other diseases, producing paraplegia. The continuous bath not only relieves further pressure, but relieves many of the painful symptoms. It is infinitely preferable to the old-fashioned water-bed.

GENITO-URINARY DISEASES**CYSTITIS**

In both man and woman the modern method for obstinate cases involves continuous irrigation. In women the forming of a vesicovaginal fistula is one of the steps in the procedure. In men bladder drainage in cases of prostatic disease is particularly offensive. In such cases the use of the continuous bath has proved indispensable wherever tried.

Cases of ulcer of the bladder, eczema, vaginitis, and exfoliative suppurative cystitis have been treated by Dr. G. L. Hunner,

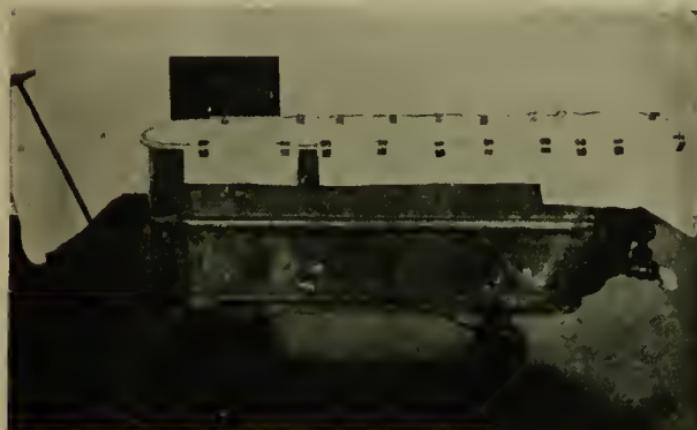


Fig. 46.—Showing tub and truck for moving it (Hunner).

of Johns Hopkins Hospital, with good results. In one case the patient was treated with continuous baths and irrigation of the bladder for over two years. The bladder, which at first held only as much as an English walnut, was finally able to retain as much as 340 cc. The patient gained in weight from 90 pounds on admission to 135 pounds on discharge.¹

Six cases are reported with good results. The technic requires a large movable tub provided with strips of canvas about 22 inches wide on which the patient rests. The ends of the canvas are held at the sides of the tub by clips. The water is kept

¹G. L. Hunner, Jour. Amer. Med. Assoc., Dec. 21, 1907.

at about 100° F. (37.8° C.) by adding hot water as cooling occurs; but when the tub is protected from radiation by covers, as in the illustration, it is not troublesome. The treatment



Fig. 47.—Showing patient in tub, with supply-tank and constant irrigation tube leading to the retention catheter (Hunner).

takes about eight hours daily. By an adjacent supply-tank continuous irrigation of the bladder by means of a retention catheter is possible.

ORCHITIS, EPIDIDYMITS, AND BUBO

These affections may be treated by applying wet compresses at a temperature of 50° to 60° F. (10°–15.6° C.). Henry Tucker¹ has lately advocated the use of a saturated solution of magnesium sulphate for the compresses, and finds that pain, swelling, and tenderness are relieved in a remarkably short time. In cases of gonorrhreal origin great relief was obtained. The solution should be applied on from fifteen to twenty thicknesses of gauze kept wet by adding the solution every half-hour or as often as necessary. At the end of twenty-four hours the gauze is removed and the parts bathed with water, reapplying the dressing if necessary. It will be found that the surface is blanched.

¹ Therapeutic Gazette, April 15, 1907.

GYNECOLOGIC AFFECTIONS

Nearly every hydrotherapeutic measure may find a place in the treatment of diseases of women. If it be desired to exert a sedative action on the pelvic organs, the warm or hot full bath or a hot sitz-bath at 110° F. (43° C.) may be chosen. The hot salt-water bath and the warm vaginal douche are distinctly relaxing. If a tonic effect be desired, cold water may be employed in the form of baths and douches. The full bath, sitz-bath, salt-water bath, Nauheim and artificial Nauheim baths, sponge bath, half-bath, spray bath, Scotch douche, and very hot vaginal douches are all useful.

General measures, such as packs, hot and cold; the drip sheet; circular douche; jet douche; sea-water bathing, etc., are obviously useful in restoring the general health and tone in patients who have lost health and strength owing to uterine, ovarian, and vaginal disorders.

The use of hydrotherapy has been greatly neglected in gynecology, especially in England and America. Recent works, however, notably Ashton's¹ work on Gynecology, and Bandler's Medical Gynecology,² lay great stress on the value of hydrotherapeutic measures.

At foreign spas, notably Marienbad, Elster, Franzensbad Tarasp, Plombières, Uriage, Wildbad, especial attention is given to diseases of women. The Nauheim system of bathing and exercises is to be recommended and the artificial Nauheim baths may be used in a wide range of genito-urinary diseases. Bandler² has arranged the following classification of diseases amenable to treatment by Nauheim baths.

DISEASES AMENABLE TO NAUHEIM BATHS

"The baths are of value in certain cases of insufficient development of the genitalia associated with relative amenorrhea and with dysmenorrhea, especially if complicated by chlorotic

¹ W. B. Saunders Co., fourth ed., 1909.

² Samuel Wyllis Bandler, The Post-Graduate, September, 1906; Medical Gynecology, W. B. Saunders Co., second ed., 1909, chap. xxii.

symptoms. The giving of iron and arsenic, as well as ovarin, is an added therapeutic measure of very great potency.

"**Uterine conditions** associated with a lack of tonicity of the muscular and vascular structures, such as are found, for instance, with uterine catarrhs. The immediate effect can be recognized by the large amount of mucus discharged after a bath, which result is produced by the increased circulation and increased stimulation to contraction on the part of the uterus. Therefore, the baths are of great value in cases of subinvolution and in persistent hyperemia, with or without an inflammatory etiology.

"Cases of **inflammatory metritis** and subinvolution fibrosis may be benefited so long as no great interstitial hypertrophy has taken place. In fact, cases of chronic induration of the uterine muscle, especially such as are associated during the climacterium with marked bleedings, should be treated with care, since an increased blood-supply is liable to produce exacerbations of hemorrhage.

"A large number of cases of **sterility** are due to a latent, very subacute salpingitis, sometimes with and often without closure of the abdominal end of the tube by cobweb peritoneal adhesions. Such instances due to gonococci, in which the inflammation has followed the course of the mucous membrane from the cervix up, are to be distinguished from septic cases due to streptococci or staphylococci, and from tubercular cases in which the peritoneal inflammation is primary and the infection of the tube secondary. We know that cases of salpingitis of the former class, in which the abdominal ends are not absolutely closed, are cases which may be cured. That adhesions may be prevented and the organization of adhesions may be avoided by these baths, I believe to be well grounded theoretically, and to be proved practically. The Nauheim bath, by promoting a normal pelvic circulation, by relieving congestion, by toning up the system generally, can cure such cases of salpingitis, and pregnancy may result. The attainment of this desired end is aided by very conservative vaginal treatment of the cervix, of cervical catarrh, and of cervical

erosions. Great stress is to be laid on the avoidance of intra-cervical and especially intrauterine treatment of any sort.

"A very beneficial action is exerted by the baths in cases of **inflammation of the pelvic connective tissue**. Cases of cellulitis in early stages, particularly such as occur after labor or abortion, are very much benefited by the administration of the baths. If the baths are given after the pelvic connective tissue is contracted and sclerosed, the benefit is much less marked. In all inflammatory conditions, if the temperature has been reduced to the normal, with or without operative measures, the increased blood-supply and the relief of congestion aid the resistance of the patient in overcoming the remaining inflammatory elements, and tend to restoration to the normal with a minimum amount of injury.

"An almost specific action of the baths is to be found in those cases of local pelvic **subinvolution** and in cases of general subinvolution so frequently associated with gastrophtosis and movable kidney. These conditions are most frequently found in women who have borne children, but occasionally in certain women characterized by a general inelasticity who have not borne children. The baths increase the tonicity of the various ligaments related to these pelvic and abdominal ptoses. The baths produce an exhilaration temporarily and an increase in strength permanently.

"Such cases, called hysteroptosis, are decidedly benefited. The patients gain in strength and weight, the number of red blood cells is greatly increased, appetite improves, and a feeling of strength and exhilaration results, such as no treatment can accomplish in the same time. In addition, the local symptoms and, what is more important, the idea that a diseased local state exists, disappear. Here, too, the addition of iron, arsenic, and ovarin is a valuable therapeutic adjunct.

"There are numerous cases in which it is desirable before operation to restore to the normal the circulation in the pelvis and to reduce to the greatest possible degree the amount of accessory exudation. I refer to cases of **pyosalpinx**, and es-

pecially to cases of **salpingitis**. Here a course of baths given before the operation aids permanent convalescence of the patient and has a tendency to prevent the occurrence of further adhesions. In other cases a course of baths administered after the operation furthers the convalescence and aids in the resorption of those stump exudates, which so frequently mar the permanent valuable results of the operative procedure.

"An unrecognized but most valuable field for the administration of the baths is found in the **postpartum treatment** of women. In my own practice, as soon as mothers are able to walk about, at some period in the third week, a course of these baths is given to aid the involution of the pelvic organs, to assist in the restoration of pelvic and general tonicity, to stimulate the nervous system, and to aid the secretory function of the breasts. I am sure that with this aid patients suffer less from loose abdominal walls, acquired displacements of the uterus, hysteroptosis, and physical and mental asthenia. I find that the patients at the end of five or six weeks are almost restored to their normal previous condition of elasticity and well-being.

"Certain cases of **obesity**, and especially such as are accompanied by a diminution in their regular menstrual flow, are benefited by a course of these baths. Not infrequently the patients lose weight, especially on a diet rich in nitrogenous elements and poor in the starchy components. Here, again, the addition of iron, arsenic, and ovarin aids in the desired result.

"A further and most valuable field for the use of the baths is to be found in the **climacteric period**. Here the nervous accompaniments of the "change of life" are often a source of annoyance and misery to the patient and her family. In those cases not complicated by climacteric hemorrhages, I am most enthusiastic about the results to be gained by a course of Nauheim baths. The asthenic physical condition, the mental depression, the irritability, the nervousness, and especially the sleeplessness, are certainly relieved to a great extent by a judicious use of these carbonated saline baths. If, with the baths, a thorough course of massage is given, and if at the same time

ovarin is administered, with or without iron and arsenic, the results in many instances are nothing short of astounding.

"Though not strictly in the field of gynecology, I must again mention the valuable action of the Nauheim bath in many cases of **rheumatism** and **gout**. Many gynecologic patients suffer from such states, and have gouty or rheumatic nodules in various parts of the body, causing severe pain in various nerves, and causing attacks of marked occipital headache and pain along the vertebra, often associated with mild or severe attacks of migraine or pseudomigraine. Here, Nauheim baths plus massage of the nodules are often productive of marked relief from the annoyance of this diathesis."

The Method of Procedure.—"Baths when begun contain 3 to 5 pounds of sea-salt, 2 to 4 ounces of calcium chlorid, and one-half box of Triton salts. In sensitive cases the Triton salts, which furnish the carbonic acid gas, are omitted from the first few baths. The water is of a temperature of 95° F. (35° C.); the duration of the bath is eight minutes. The patient lies quietly in the bath. At the expiration of the stated time the body is dried gently, preferably with warm towels, and the patient then lies down in bed for one hour, first taking a cup of hot milk or weak tea. At the expiration of this hour the patient can resume her daily vocation, being careful to avoid great exertion of any sort. Baths are best taken in the morning, at least two hours after the meal. The baths are taken three days in succession, then comes an interval day on which no bath is taken, then three baths more are taken, then comes another interval day, and so on, until about twenty baths have been administered. No baths, of course, are given during menstruation. Each set of three baths is made a little stronger by the addition of a little more salt, a little more calcium chlorid, and more of the Triton salts, but only if patients stand the baths well. The last three to six baths contain 8 to 10 pounds of sea-salt, 8 to 10 ounces of calcium chlorid, one and a half boxes of Triton salts. The temperature by this time has been reduced to 85° F. (29.4° C.), and in some instances to 80° F. (26.7° C.). The lowering of the tem-

perature depends upon the manner in which the patient bears the abstraction of heat. No patient should leave the bath feeling cold or chilly. The last baths should have a duration of eighteen to twenty minutes. The beneficial effects of these baths are very much enhanced by a subsequent change of air for from two to four weeks at an altitude of 1000 to 2000 feet. In almost all cases, and especially in cardiae cases, the administration of digitalis after a course of baths produces an extremely beneficial tonic effect." The author finds that the Dr. Zucker carbonic acid bath is very satisfactory (see p. 313).

Modification of Nauheim Baths.—Bandler recommends a modification of the general Nauheim baths for cases in which it is desired to secure a purely pelvic effect, such as mild subacute pelvic inflammations. This consists of sitz-baths containing enough water to cover the pelvis up to the umbilicus when the patient is in the sitting position. This bath should contain from 3 to 5 pounds of sea-salt and from 3 to 6 ounces of calcium chlorid and should be applied at a temperature of from 95° successively reduced to 85° F. (35°–29.4° C.), lasting for from ten to twenty minutes. This procedure is usually followed by an improvement in the pelvic circulation and relief of congestion and the slighter degrees of pain.

SITZ-BATHS IN GYNECOLOGIC AFFECTIONS

These may be given cold, from 50° to 75° F. (10°–23.9° C.), or hot, 104° to 114° F. (40°–45.6° C.). They require a special form of tub (see p. 336), so that the patient may sit in water reaching to the umbilicus. A blanket should be placed about the patient and the feet should be kept in a foot-tub filled with warm water. The duration of the bath is from ten to thirty minutes. Cold sitz-baths at 85° to 80° F. (29.5–26.8 C.) are best given in the morning or afternoon and are stimulating to the pelvic and abdominal organs. Hot sitz-baths are best taken at bedtime.

EYE DISEASES

EXTERNAL AFFECTIONS

In **ophthalmia neonatorum** cold compresses should be used in connection with silver salts. In the early stages, when the lids are tense and there is little secretion, small square compresses of patent lint (perfect absorbent lint) are kept on a block of ice until needed, applying them every half-minute, day and night, for the first thirty-six or forty-eight hours (see p. 344).

Fomentations are also used in conjunctivitis neonatorum, especially when corneal complications exist or the conjunctiva is covered with a gray film. These are applied with squares of antiseptic gauze wrung out of earbolized water at 120° F. (48.9° C.), and should be frequently changed. They are used in connection with irrigation of the eyelids (see p. 347).

In **diphtheritic conjunctivitis, trachoma, and granular conjunctivitis** cold applications should be made early in the attack.

In **phlyctenular conjunctivitis** hot compresses applied to the eye for five or ten minutes every three hours are recommended.

Early in **iritis**, compresses, as hot as can be borne, are useful to relieve pain (see p. 349).

INTERNAL OCULAR AFFECTIONS

Sweating Processes.—Various internal ocular affections are successfully treated by hydrotherapy, especially those which produce marked diaphoresis. Drugs like jaborandi and its alkaloid, pilocarpin,¹ have been used in the treatment of vitreous opacities, chronic iridochoroiditis, hemorrhage into the vitreous and retina, toxic neuritis, and detachment of the retina, with great benefit. But it is in this class of cases that sweating processes, produced by mechanical means, are especially ap-

¹ Weber, Centralblatt für Klin. Med., 1876; Burham, Proceedings of Section on Ophthalmology, Brit. Med. Assoc., August, 1897.

plicable. Some ophthalmologists, such as Hansell and Risley,¹ place much reliance in hot packs and electric-light baths.

It is not necessary to resort to hot baths as a preliminary measure. There is danger of temporarily greatly weakening the patient, and instances are cited in which patients bathed at a temperature of 106° or 110° F. (41.1° or 43.3° C.) have lost consciousness for a few moments at the conclusion of the bath. The method which Hansell strongly advocates is as follows:

Hansell's Method.—A rubber sheet covers the mattress on which the patient lies enveloped in three thick blankets. On each side, extending from the feet to the shoulders and as close to the skin as the heat will permit, are placed hot-water bags or bottles. A cup of hot fluid, preferably tea, is drunk. The sweating commences almost at once, and, by renewing the hot-water bags or bottles; may be continued for the desired time. A glass of ice-water, one-half hour after the process has commenced, will serve to stimulate the sweat glands and increase perspiration. During the entire period an ice-cap or a towel frequently wrung out of cold water should be placed about the head and forehead. The duration of the pack should not exceed an hour and a half; longer than this is liable to enervate the patient and detract from the value of the treatment. At its conclusion the body should be well dried and rubbed with alcohol; the patient dressed with warm dry night clothing, and placed in bed with warm dry sheets and blankets, where he experiences a feeling of rest and relaxation.

The most convenient hour for the treatment is in the early afternoon, the patient remaining in bed until the next morning, when he may dress, and, if the weather be suitable and other circumstances permit, he may take exercise out of doors.

Risley's Method.—This involves the use of an electric-light bulb of 24- or 32-candlepower, which is hung underneath the top of a cage enclosing the patient. Air is prevented from entering the cage by blankets and other covering, only the head of the

¹ See article by Howard F. Hansell, Pennsylvania Medical Journal, 1907, pp. 886-890.

patient being exposed. Electric pads enclosed in a flannel covering and provided with a thermostat may be used instead of the electric bulb, and, being automatically regulated, there is no danger of exceeding a given degree of heat.

The *number of sweats* and their frequency depend upon the severity and chronicity of the disease and upon the physical qualities of the patient. In acute inflammation a week or ten days may be sufficient; in chronic inflammations they may be continued for three weeks, particularly in corpulent subjects.

The *duration* cannot be accurately stated beforehand. By noting the general and local effect and especially the body temperature the physician is guided as to his course. It will probably be found that at the conclusion of the bath the body temperature has risen to 102° or 103° F. (38.9° or 39.5° C.), with a corresponding acceleration of the pulse. Two or three hours later both should have returned to normal. Delayed or a subnormal temperature indicates physical weakness, and before the next bath strychnin should be given hypodermically. If, in spite of the strychnin or other stimulant, the temperature remain high, the baths should be interrupted or altogether discontinued.

Suitable Cases.—The class of cases suitable for the hydrotherapeutic methods above described includes inflammation of the sclerocornea, of the uveal coat, of the chorioretina, and of the optic nerve. The treatment is most valuable, according to Hansell, in chronic inflammation associated with exudation in large amount of the uveal coat, with secondary involvement of the tissues immediately adjacent. After the stage of atrophy and connective-tissue change, nothing may be hoped for. Even after the ophthalmoscope indicates that exudation has given place entirely to connective tissue, improvement may yet take place.

In alcohol and tobacco amblyopia the method of baths and packs associated with the use of strychnin are of the greatest value, especially if treatment be instituted before the stage of atrophy of the fibers of the optic nerve.

In glaucoma the high vascular pressure calls for a tranquil environment. Hot foot-baths of ten minutes' duration, with

the addition of salt or mustard, may prove useful. Full hot baths or sitz-baths are likely to aggravate the condition, but if tepid water be used at 85° to 90° F. (29.4°–32.2° C.) there will be no injurious effect.

The following cases cited by Hansell are typic of the value of hydrotherapy in ocular affections:

CASE 1.—Mrs. X. One year previous to treatment she became innocently infected with syphilis. The usual secondary symptoms followed and she was treated with mercury and potassium iodid. Four weeks before consulting Dr. Hansell iridocyclitis had developed in the right, and two weeks before the same condition developed in the left eye. Vision at the time of examination was: R., counting fingers at one foot. L., $\frac{2}{3}\pi$. Total posterior synechiae and vitreous opacities in both. No view of the fundus of either eye could be obtained. One week after commencing the sweats and mercurial inunctions the synechiae were almost all broken off, the vitreous had regained, to a large extent, its transparency, and vision had improved to $\frac{2}{3}\pi$ in each eye. After several weeks the patient was able to read and could see practically as well as ever. This patient had seven sweats, each one and a half hours in duration, and mercurial inunctions carried to the point of saturation.

CASE 2.—A clerk, aged twenty-six. Four months before he came under observation he had fever with pain in the abdomen and back and some bladder trouble, the nature of which was not ascertained. He recovered in a few days, and during convalescence vision became affected to such a degree that he made his way with difficulty. He complained of headache and diplopia before and during his illness. Vision $\frac{2}{3}\pi$; the fields were concentrically contracted for form and almost entirely lost for colors, recognizing blue only at the fixation-point with the right eye. The diagnosis was acute double optic neuritis. The patient was given mercurial inunctions and sweats for nine consecutive days. Ten days after beginning treatment vision had improved to $\frac{3}{4}\pi$, the fields had widened nearly to the normal limits, all colors were recognized, and the optic nerve and adjacent retina were free from edema.

INDUCED PHENOMENA DURING A COURSE OF HYDROTHERAPY

It should not be forgotten that latent foci of infection may be aroused to renewed or primary activity during a course of hydrotherapy. This is probably more liable to occur when the patient is under treatment for some surgical condition. An auto-inoculation or reinoculation may be brought about by douches and packs and a more or less severe reaction ensue.¹ Kraus has

¹ See p. 120, article on Rheumatism.

applied the term "Provokationserscheinungen" to phenomena of this type.

For example, in a patient who was being treated with local douches and packs to relieve chronic recurring pain in the perineal region, with other measures for an old chronic urethritis, signs of small abscess in the prostate became apparent on the fourth day of treatment.

Kraus has noticed that patients sometimes complain of tooth-ache after hydrotherapeutic measures. This is not neuralgia, but merely the flaring up of some latent carious process. It is obviously desirable to have the teeth put in order before undertaking the various "cures," especially when these involve long journeys.

In all cases of pyosalpinx or gonorrhreal genital processes there is the possibility that these may take on an acute activity. In such cases, as well as in gonorrhreal joints and other forms of arthritis, one should endeavor to obtain that degree of hyperemia which promotes the absorption of morbid products. A happy mean between too little and too much is desirable. *In mediis tutissimus ibis.* Those who have had a large experience in the treatment of gout and rheumatism are familiar with these unpleasant events. To the patient it is always a disheartening and trying period, to which he is rarely submissive.

A few days of rest, however, usually restores his equilibrium. As Kraus remarks: "The tissues must be coaxed into proper assimilation." Experience brings skill in the application of the measures, and this is the main point, and not so much the special technic.

The disturbance of the vasomotor reaction to the nerve stimulus is liable to persist longer in nervous persons with a tendency to arteriosclerosis. There may be nervous crises, vertigo, or buzzing in the ears, but these are usually transient and, although the arteriosclerosis may not be cured, the symptoms may be abated. The aim should be to adapt the work of the tissues to the given disturbances.

TECHNIC OF HYDROTHERAPY

“If to do were as easy as to know what were good to do, chapels had been churches, and the poor men’s cottages princes’ palaces.”—*Merchant of Venice*, i, 2.

Centigrade. Fahrenheit.

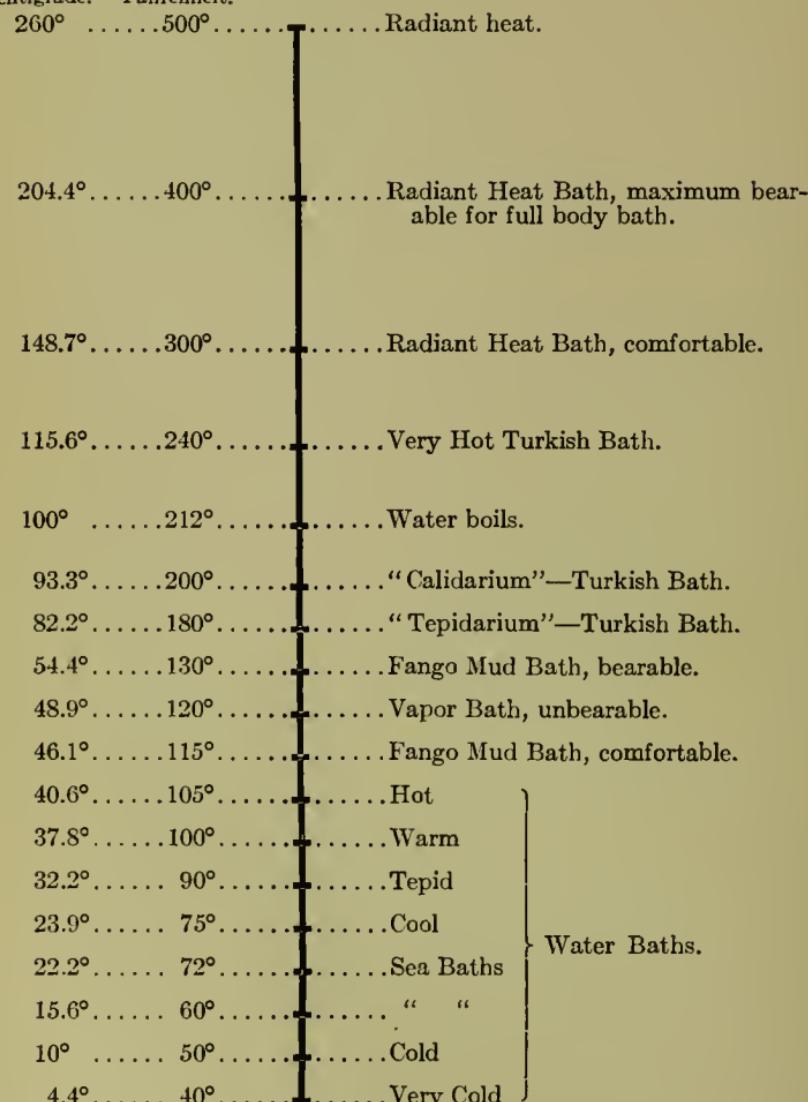


Fig. 48.—Chart showing thermometric equivalents (Luke).

**STANDARDS OF TEMPERATURE, IN DEGREES FAHRENHEIT, USUALLY
ACCEPTED IN HYDROTHERAPY**

Bath.	Water.	Vapor.	Air.
Cold.....	40° to 65° F. (4.4°–18.3° C.).		
Cool.....	65° to 75° F. (18.3°–23.8 C.).		
Tepid.....	85° to 95° F. (29.4°–35° C.).		
Warm.....	95° to 100° F. (35°–37.7 C.).	100° to 115° F. (37.7°–46.1° C.).	110° to 120° F. (43.3°–48.8° C.).
Hot.....	100° to 110° F. (37.7°–43.3° C.).	115° to 140° F. (46.1°–60° C.).	120° to 180° F. (48.8°–82.2 C.).
Very hot.	110°–120° F. (43.3°–48.8° C.).		or more.

Bath Thermometer.—The most important piece of apparatus in hydrotherapy is the bath thermometer. The trouble with most bathing attendants is that they do not rely sufficiently on a good instrument, easily read. It takes young eyes and a good light to read the scale on the cheap bathing thermometers in common use.

**EFFECTS OF EXTERNAL APPLICATIONS
OF HEAT AND COLD**

It is generally believed and stated that heat can be conveyed to or abstracted from the deeper structures of the human body by external applications. This is probably true only to a very limited and comparatively superficial extent. Schultze has claimed that an ice-compress can reduce the temperature 3.5° F. (1.9° C.) nearly 1 inch below the surface, and 7° F. (3.8° C.) on the inner surface of the thorax. Esmarch undertook to measure the influence of cold on the body. He inserted a thermometer into a carious sinus in the leg and applied an ice-bag for nine hours and noted a fall of 50° F. (10° C.). Similar results were obtained by immersion and also by irrigation with



Fig. 49.—Bath thermometer.

cold water. Schweinburg and Schlikoff claim a lowering of temperature when ice is placed on the surface and measurements are taken in the mouth, the vagina, the bowel, and the pleural cavity. When ice was placed on one side of the thorax a lowering of the temperature in the opposite side of the thorax, amounting to 6.7° F. (3.7° C.), was noted. Winternitz, Silva, Hertel, and Kowalski have recorded similar experiments, which show an undeniable temperature effect on the deeper structures when superficially applied.¹

Dr. W. Gilman Thompson, of New York, in some unpublished experiments privately communicated to the author, arrived at very different results. He passed some long-stemmed thermometers into thoracic sinuses of patients who had been operated upon for empyema and also into the female bladder. Very hot poultices were then applied to the external surface, followed by ice-bags. The thermometers were never affected more than $.125^{\circ}$ F. ($.0675^{\circ}$ C.). Similar tests were made within the cheek, with the same negative result. Dr. Thompson excised ribs of dogs and fitted in glass windows with a double flange, so that the pink lung played against the window. Poultices applied to the external surface produced no temperature effect, although in all similar experiments on the cadaver the temperature was decidedly altered at once. In the latter case there is no layer of constantly moving blood beneath the poultices or the ice to quickly convey away the thermal units.

The obvious reason of the failure to influence the deeper structures of the human body is that the small amount of heat units contained in any ice-bag or poultice is ridiculously small in comparison with the total units in the body. For this reason Dr. Baruch is opposed to the common practice of applying an ice-bag to the abdomen in case of hemorrhage occurring in typhoid fever.

Dr. Thompson points out that the bronchial and pulmonary vessels spring from such different sources from those supplying

¹ Schweinburg, *Handbuch der Allgemeinen und Speciellen Hydrotherapie*, Wiesbaden, 1904, pp. 16, 17.

the external thoracic wall that there is no reason why they should be affected.

The fact that these applications relieve pain depends on an entirely different *modus operandi*. Neither should it be inferred that in pneumonia, for instance, there is no beneficial effect, notwithstanding that the external applications cannot reach the deep inflammation (see p. 101). Of course, the less vascular the parts the more appreciable will be the effects.

In applying water therapeutically to the body, mention will be made of some of the principal measures shown by ex-



Fig. 50.—Clow metal pack table and requisites.

perience to be reliable. Acknowledgment is made to Professors Winternitz, Strasser, Baruch, Schweinburg, Jurgensen, of Kiel, Buxbaum, Brand, J. C. Wilson, Luke, Pope, Wright, and others, who have done so much to systematize the science and practice of hydrotherapy. The cooling or heat-abstracting measures will be considered first, and afterward the local and general applications of heat will be described. Many of these procedures are carried out while the patient is reclining in bed, and it is very convenient and much more sanitary to have a narrow metallic

bed for this purpose. A special bed, rendered perfectly safe by a strong spring, has been designed by Dr. Rebekah B. Wright.¹



Fig. 51.—The pack prepared.



Fig. 52.—Application of the cold pack (pressing the sheet between the patient's arm and body) (Stoney).

It is made of steel tubing white enamel, 30 inches high, 6 feet long, and 22½ inches wide. In hospital or sanitarium practice

¹ This bed is made by the Clow Company, Chicago.

it is sometimes necessary to restrain a patient, and for this reason the width of the bed is an important consideration.

BATHS

THE COOLING WET SHEET PACK

A linen sheet, saturated in water at 70° F. (21.1° C.), should be wrung out slightly and wrapped about the patient, taking care to apply it closely to the body and around each limb and snugly about the neck. The patient may be lightly covered. In a few minutes, as the sheet warms, a second sheet, similarly prepared, is applied in place of the first one, and so on until five or six applications have been made at intervals of about five minutes. Friction with the hand outside the sheet promotes cutaneous circulation, and the temperature of the febrile patient may fall 1° F. ($.54^{\circ}$ C.) or more. Friction increases the heat loss about 95 per cent., and should be used after all cold applications.

This pack is modified by opening up the sheet and sprinkling the body and the sheet with a sprinkling-can holding water at 40° to 45° F. (4.4° – 7.2° C.), allowing the patient to turn slightly to receive it on both sides. Provision should be made to protect the bed and drain the surplus water.

THE EVAPORATION BATH

Place a mackintosh and blanket under the patient. Cover the patient, both extremities and trunk, with one thickness of gauze moistened in water at 115° F. (46.1° C.). Have the gauze fit the skin snugly. Fan the patient with a palm-leaf fan and moisten the gauze, as evaporation takes place, with the water still maintained at 115° F. (46.1° C.). One pint of water should be evaporated in fifteen minutes. A hot-water bag is placed at the feet and a compress on the forehead.

To keep the water at 115° F. (46.1° C.) the basin should be placed in a larger one containing water of a higher temperature.

Cold applications in the absence of ice or cold water may be obtained by the use of nitrate of ammonium. To 1 quart of water add $\frac{1}{2}$ pound of the nitrate. If the water used has a temperature of 70° F. (21.1° C.) it will soon lose nearly 30° F. (16.2° C.) as the salt passes from the solid to the liquid state. This principle is utilized in the manufacture of artificial ice.

THE COLD BATH

For fairly vigorous persons the best time for the cold bath is before breakfast. Weak or delicate persons may take it in the forenoon. Chill, languor, or drowsiness coming on after cold baths are counterindications to their continuance; tepid baths are then to be substituted. As stated above, vigorous friction should always follow the use of cold.

The water of the cold bath is usually drawn in a tub from the public supply, and varies, according to the season, from 40° to 70° F. (4.4°–21° C.). The cold bath is the favorite one of the Anglo-Saxon race. All are familiar with the determination with which the Englishman, wherever he is, ensures his morning cold bath, and undoubtedly it has an influence in promoting his vigor and his well-known appearance of health. It is a rather curious fact, however, that the English, while devoted to bathing as a hygienic measure, have not shown a corresponding devotion to hydrotherapy as a science and a valuable department of therapeutics.

Cold plunge baths and cold full baths belong to the same category, and accomplish very much the same purpose, differing very little unless in the amount of water used and the extent of immersion.

The **plunge bath**, as usually understood, is nothing more than the morning dip in the tub about half-filled with cold water, which may range from 45° to 70° F. (72°–21.1° C.). The body is vigorously rubbed while in the bath, and water is carried over the head and shoulders by a large bathing sponge. The whole body is quickly rubbed with the hands, the bather sitting up. They both may occupy from half a minute to three

or four minutes, according to circumstances and the relish which the bather has for cold water. If a pool be at hand, the plunge may be had in its full significance. After a few seconds in the plunge the bather emerges for a quick rub with coarse Turkish towels and quickly dresses. A feeling of invigoration is generally experienced.

This is the sort of bath the writer has taken for many years, and he would not exchange it for any other bath mentioned in this book. Nevertheless, he by no means approves of it for everybody. Dr. Norman Bridge is equally enthusiastic about the hot morning bath, and thinks it absurd that the average man, sick or well, should enjoy getting out of a warm bed and plunging into a tub of cold water.

According to Dr. Bridge, "it is in the popular mind, among many of the more fastidious of us, that a daily bath, or one nearly every day, is necessary for health. That venerable error which reads, 'cleanliness is next to godliness' has become part of the religion of a great number of people. Some kind of a bath must, they think, be taken, and the only one that is really pleasant, the warm and hot bath, is forbidden by lay opinion, and to a large extent by professional opinion also, as being dangerous when taken in the morning, and so the cold seems inevitable. The hot bath is more agreeable to nearly everybody than the cold, but we have been taught for generations by putative hygienists, by books, professional and otherwise, by many thoughtful physicians, and a little, it may be, by an ethical fetish inherited from some severe religious past, that whatever is pleasant must be in some measure a sin—that a hot bath invites cold catching, and is, therefore, positively dangerous, unless taken just before going to bed, or unless it is ended by a douche of cold water or by a cold plunge. The theory that has gained currency is that the heat of the bath 'opens the pores' and leads to cold catching or some other peril, unless the 'pores' are shut up by the cold dash taken at the end of the bath. So it has come to be a part of the very positive directions generally given for a warm or hot bath, especially

if taken in the morning or before going out into the weather, that the end event of it shall be this same cold dash."¹

Of course, the propriety of cold morning plunges varies wholly with the individual, his powers of reaction, his position in life, and the climate in which he lives. What is best for a man in Boston or Montreal may be wholly different for a man in New Orleans or Southern California. A man who leaves his house at 9 or 10 o'clock in the morning can do many things unsuited for the man whose "morning's at seven." It is believed that better powers of endurance are developed by the cold morning bath, and that, used with judgment, a process of hardening ensues which fortifies the system against surrounding dangers.

The morning dip in cold water has a tonic influence on flabby abdominal muscles, and is advised for the relief of sluggishness of the gastro-intestinal tract, defective nutrition, obesity, and autointoxication. It corrects mental torpor, lassitude, headache, and listlessness.²

Cold full baths, 50° to 60° F. (10°–15.6° C.), should last for only a minute or less; if from 60° to 70° F. (15.6°–21.1° C.), they may last for a little longer. A large tub is required, so that the entire body can be submerged up to the neck. These baths produce a tonic effect, deepen respiration, and favor a better ventilation of the lungs, just as in the case of plunge baths. The appetite is sharpened, digestion improved, peristalsis is increased, and constipation prevented or relieved. Short stimulating baths of this type tend to correct enteroptosis, dilatation of the bowel, and intestinal intoxication. One reason why women suffer from habitual constipation much more commonly than men is possibly due to the greater popularity of the cold morning bath among men, whereas women favor the more relaxing tepid bath.

Counterindications.—Cold and cool full baths are counter-indicated in spastic and mechanical constipation, acute inflam-

¹ Trans. American Climatological Association, 1906.

² For a discussion of baths for the relief of constipation see Constipation and Intestinal Obstruction, chap. xxii., by Samuel G. Gant, M. D., 1909.

matory affections, like appendicitis, peritonitis, and gastritis, in pronounced anemia, and during gestation (Gant). It is also counterindicated in advanced life and at any age when arteriosclerosis exists. Cardiac weakness, emphysema, and bronchitis are better treated by hot sponge baths.

Sir J. Floyer, who wrote a notable treatise on hydrotherapy two hundred years ago, was a strong advocate of the cold bath, but it is noteworthy that on the title page of his first edition he added the words, "proving that the best cures done by cold



Fig. 55.—Janeway's bed lift.

baths are lately observed to arise from the temperate use of hot baths first." He wisely recognized that warming procedures render the subsequent use of the cold bath safer and more effective. An exception to this general principle is, of course, the Brand bath in typhoid fever.

Bed Lift.—A helpless patient, or one whose great weight or mental condition presents difficulties, may be removed from the bed to the tub and back again by means of a bed lift. The best device is that of Dr. H. H. Janeway.¹ It has the advantage

¹ Journal Amer. Med. Assoc., Oct. 6, 1906, pp. 1093, 1094.

of lifting the patient directly from the bed into the tub with



Fig. 54.—Janeway's bed lift.



Fig. 53.—Janeway's bed lift.

perfect safety and with little exertion on the part of the nurse. It can be operated by one person.

Four stout, broad bands of webbing, with triangular steel attachments at both ends, are placed under the head, the thorax, the pelvis, and the legs. The steel bar (Fig. 53) is then lowered by means of stout rope and pulleys connected with a substantial steel frame, set in cross-shaped wooden base and operated by a windlass. The patient is then lifted bodily from the bed (Fig. 54). It is then a matter of only a few minutes to remove the bed for renovation and to place the movable tub in position. By using extra bands and varying their position any part of the back can be exposed to the bath or given special dressings. By depressing the bar above the feet the head need not be allowed to come in contact with the water. In cases where one nurse only is on duty, bathing becomes perfectly practicable if this apparatus be at hand.¹

THE SO-CALLED "HALF-BATH" OF PRIESSNITZ

This is really a shallow bath, the water reaching to the umbilicus, but its application involves the whole surface of the body. It is a powerful tonic when applied with water at 65° to 75° F. (18.3°–23.9° C.), and should occupy from three to five minutes. The tub is filled to a depth of 5 or 6 inches. The patient should enter from a warm bed, or his circulation should be stimulated by exercise. As soon as he enters the water he rubs his limbs, while the attendant rubs the chest thoroughly for a few moments with both hands and then takes the limbs in turn. The attendant repeats the rubbing of the various parts quickly once or twice more. The shallow water enables the attendant to get at the various parts more readily than in the full bath.

The half-bath or shallow bath is useful in cases of anemia and in many chronic diseases of the spinal cord; in cardiac affections and usually in cases of asthma oppressed by the Turkish or Russian bath. It is also valuable in chronic affections of the stomach and in constipation. At the higher tem-

¹ This bed lift may be obtained from Charles E. Dressler, 143 East 23d Street, New York City.

peratures it is suitable for cases of sciatica and all painful affections of the lower extremities and pelvis.



Fig. 56.—Half-bath with affusion (Cohen).

The popularity of this bath has increased among Continental physicians and is having a great vogue throughout Europe.

SPRAY BATH

Technically, the spray bath, designated by French clinicians *bains à l'hydrofère*, consists in applying to the skin of the patient a continuously fresh layer of water in a finely divided state. A specially devised spraying apparatus is used, which affords a mechanical impact to the skin, exerting a marked sedative effect on the nerves and removing secretion. Mineral waters with gaseous and solid contents are used in this way at European resorts.

This bath is practically a douche of very fine streams issuing

from a large perforated rose nozzle attached to rubber tubing. It may be applied horizontally or in any other position.



Fig. 57.—Sprinkler with temperature-indicating handle, designed by Dr. A. F. Shepherd of the Ohio State Hospital for the Insane, Dayton, Ohio. It is made of metal, which instantly takes the temperature of the water passing through it, thus indicating to the attendant any slight variation in the temperature of the water. See also the thermometer illustrated on p. 368.



Fig. 58.—Spray bath and ice rub (Cohen).

The spray bath is eminently suitable for treating sunstroke. The patient should be stripped and put on a cot covered with a

rubber sheet and an ice-cap applied to his head. The water is supplied from the nozzles in a fine spray at the lowest temperature afforded by the public supply, or from a supply cooled to a temperature of 55° or 60° F. (12.8° or 15.6° C.). When the rectal temperature reaches 103° F. (39.4° C.) he may be wrapped in blankets and made comfortable in bed; the process being repeated if the temperature rises. In subsequent baths it may be possible to reduce the temperature to 101° F. (38.3° C.).

For the use of the spray bath and ice rubbing in the treatment of typhoid fever see pp. 71 and 75.

THE ABLUTION OR WET MIT FRICTION

Teilwaschung of the Germans. It is the mildest general treatment, and can be employed to advantage even in the treatment of feeble, bedridden patients. The water is best applied with a wet bath mitten. One part of the body after another should be rubbed, first with cold water, 50° to 75° F. (10°–23.8° C.), and then with a rough towel. If the circulation is poor, alcohol may be added to the water. The skin of the part treated should become red and warm. The intensity of the local reaction furnishes a guide to the selection of the proper tonic measure. If a good reaction is obtained with the ablution, stronger measures may be used, of which the douches have the greatest range of usefulness.

THE DRIP SHEET OR SHEET BATH

This important measure requires very little apparatus. The best time for its application is late in the afternoon or toward night. The requisites are a pail or large basin of water at 65° F. (18.3° C.); a foot-tub with water at 100° F. (37.8° C.); ice-water; two face towels; a bath towel; a bed with an extra blanket at hand, and protection for the floor. Put the sheet into the water, letting the corners hang out. The patient, dressed only in one garment, stands in the foot-tub containing the warm water. One face towel is then dipped in ice-water, wrung out, and wrapped about the head like a turban. The nurse then places the pail

of cold water with the sheet behind the patient, and, while standing in front, seizes the wet sheet by two corners and throws it around the patient, *without any attempt to wring out the sheet*. A rough, smart rapid rub applies it everywhere. This process should occupy about two minutes. Then drop the sheet and wrap in the dry blanket, and put the patient to bed. Lower the temperature of the water 1 degree each day until 55° F. (12.8° C.) be reached.



Fig. 59.—Drip sheet or sheet bath (Ashton).

This is the quickest and simplest method of applying the drip sheet, and may be modified or extended by slapping the surface occasionally with the hand or a wet towel, thus increasing the mechanical irritation of the skin. In addition, a basin of water 10° F. (5.4° C.) colder than the water used for the sheet should be provided, from which water is poured over the head and shoulders two or three times at short intervals, being alternated with slapping and friction for from five to ten minutes. In any

given case the physician may judge whether to commence moderately or with the full technic. The general effect is moderately sedative, with the abstraction of considerable heat.

SPONGING

Before sponging a patient, note first the exact temperature. Have water ready at between 80° to 90° F. (26.7°–32.2° C.) and also at 60° F. (15.6° C.). Remove all clothing from the patient and have blankets over and under him. Put the basins, sponges, and six soft towels, etc., on a table near by, so that it will not be necessary to leave the patient for any reason whatever. Commence the sponging at the face and neck, applying a cold compress at 60° F. (15.6° C.) to the head and forehead after sponging. Sponge downward, exposing only one limb at a time. When the whole body has been sponged, the patient should be dried, dressed in a night gown, wrapped in a warm blanket, and left undisturbed in bed for an hour or longer. The temperature should be taken at the end of each sponging and at the end of the hour's rest.

Cold sponging is better borne by sensitive patients if there be a preliminary sponging with tepid water, 80° to 90° F. (26.7°–32.2° C.), before applying the water at 60° to 70° F. (15.6°–21.1° C.). A hot bottle at the feet during sponging is comfortable to the patient and may ward off a chill or tendency to collapse.

Patients who are not particularly weak do not need to be so carefully dried; the arms, back, and chest may be left to dry by evaporation.

After the sponge the temperature usually falls from 1° to 3° or 4° F. (.54°–16.2° or 2.2° C.), the rapidity and extent of the fall corresponding to the coldness of the water employed. Ammonia, alcohol, cologne, water, or vinegar added to the water favors cooling by rapid evaporation.

In the absence of a suitable sponge, towels may be wrung out of cold water dry enough not to drip, and placed about the body, from the neck downward. When the feet are reached,

begin again at the head and renew each in succession, continuing as long as necessary.

Abdominal Cold Compress.—To enhance the value of the sponge bath, an abdominal cold compress is sometimes applied after sponging. This is made by dipping two towels into water at 60° F. (15.6° C.), and, after partly wringing them out, they are unfolded and placed across the abdomen and covered with a thick Turkish towel, passed around the body.

RUBS

THE OIL RUB

In temperate climates it is probable that the main advantages from such anointing is due to the massage; in other words, the circulation of the skin is improved, the muscles are cleansed of excrementitious products by such débris being forced into the lymph circulation, and the flow of blood through the muscles is improved. The oil rub has also a good therapeutic use when the skin of the patient is always dry and scaly. Such people probably do not have a normal secretion from the thyroid gland, but whatever internal medication is deemed advisable, the oil rub will add to the improvement of the skin condition.

In tropical countries the oiled skin radiates heat more rapidly than the dry skin when little or no clothing is worn. On the other hand, in cold countries, where much clothing is needed, the oiled surface of the body keeps the body warmer. It also seems to be a fact that after hot bathing a patient who catches cold readily has less liability to chilling if an oil rub is given.

Locally, oil rubbing may be used, after hot bathing, for cold feet or cold legs, and the feet of such patients will remain warm longer than without it.

Although it has been stated that oil may be rubbed into the body so as to increase nutrition, and that weakly patients, especially infants, will improve, it is still a question if it is not the general toning up of the circulation, the equalization of the

circulation, and the prevention of flabbiness of muscles—in other words, the effects of the massage—that are the real cause of the improvement in the general condition.

The body should be first bathed with warm or tepid water, dried, and the oil then applied; it should not be applied to the dry, unwashed skin. The oil should, of course, be pure and clean, should be well rubbed into the skin, and any surplus should be removed with a soft towel. Some knowledge of massage is necessary to a successful oil rub, and the rubbing should not be sufficiently vigorous to cause perspiration. The best oil for this purpose is pure olive oil, cocoanut oil, or palm oil; cottonseed oil may be used. Animal fats do not make an ideal oil rub.

THE SCOTCH RUB

This is applicable to patients to whom a cold-water rub is unpleasant, and consists in washing a part of the body with hot water and then rubbing with a towel wet in cold water. "If under such applications the skin slowly redden or stay pale and the skin muscles are contracted, it means an abnormally high excitability of vessel innervation." This condition is found in anemia and in some feverish conditions. "A livid redness of the rubbed area means circulatory insufficiency," while a slow rewarming or continued coolness of the treated area in high fevers "is suggestive of a pending circulatory collapse." The advantages are that the friction is a mild stimulant and causes the rubbed area to radiate heat normally, while it also increases evaporation.

The advantage is that this method is pleasanter to most patients than cold sponging, and while not tending to lower temperature immediately as effectively as does the typical old sponging, it does tend to keep the surface of the body in a healthy condition and causes the skin to give off heat rather than to retain it.¹

For Salt Rub or Salt Glow, see p. 354.

¹See Dietetic and Hygienic Gazette, September, 1908; British Journal of Nursing, 1908; Jour. Amer. Med. Assoc., November 14, 1908.

ALCOHOL RUB

This is an adjunct to hydrotherapy of great value, usually employed as a terminal measure. It improves the circulation and adds tone to the skin, and after packs or douches prepares the skin for contact with the outside air. Only grain alcohol should be used, and it may be used slightly diluted or pure. About 2 ounces are sufficient for each rubbing of the entire body.

DOUCHES

Douches may be applied to individual portions of the body, depending upon the particular organs or structures affected. The jet, the spray, the fan, or the filiform douche may be chosen as the parts require, and they may be short, prolonged, hot or cold, or alternately hot and cold, and under greater or less pressure—from 10 to 35 pounds to the square inch.

Cold applications, lasting one or two minutes, are strongly stimulant, producing a vigorous reaction in most cases. The entire vascular and lymphatic systems immediately underlying the exposed part are affected in proportion to the pressure under which the douche is applied. If no pressure accompany the cold, the action is superficial, but may in certain localities produce reflex stimulation.

Hot applications allay pain or benumb the superficial cutaneous nerves. At a temperature of 90° to 100° F. (32.2°–37.8° C.) they produce local and reflex sedative effects.

NEEDLE DOUCHE; NEEDLE SPRAY; CIRCULAR DOUCHE

In its most effective form this douche is delivered from a series of "roses" having minute perforations, and arranged at different heights on an upright system of tubes connected with the control table. In modern appliances there are usually sixteen roses, the upper row being adjustable to discharge the spray at an inclination downward, so as to avoid the head and face. These roses can be adjusted to suit patients of different heights. The small volume of water emerging in the needle

douche allows a somewhat higher pressure than in douches of larger volume. There is, however, a sharp stimulus to the skin from these innumerable jets of small caliber, which gives a sensation of needles, suggesting the name. The douche should be started by the operator before the patient takes his position, so as to avoid any unexpected high temperature. Water contained in the pipes is thereby allowed to run off, and when the thermometer stands at the required initial temperature the patient may be called from the adjoining cabinet bath, in case this be used as the preliminary warming measure. He enters the douche and turns around slowly to permit the spray to strike all parts of the body below the head. The illustration shows that the two lower series of roses expend their force chiefly in zones, but this is not an objection to the arrangement.

Hydrotherapeutic prescriptions frequently call for the hot-air bath or electric-light bath as a preliminary measure. This is usually to insure more or less perspiration and capillary dilatation. The electric-light bath for five or six minutes, or the hot-air bath for eight, ten, or twelve minutes or possibly longer, is then followed immediately by the circular douche of the prescription. From one to two minutes is usually sufficient, and during that time the operator has the opportunity of lowering the temperature of the water as may be prescribed. As a rule, there is no need or advantage of a change in the initial pressure. The author does not approve of prescriptions calling for a rising temperature. The advantage is not commensurate with the danger of overstepping the mark. He rarely orders an initial temperature of over 105° F. (40.6° C.), believing this sufficient after the use of the cabinet, in which the temperature is usually at 150° to 160° or 165° F. (65.6°–71.1° or 73.9° C.). To raise the temperature of the needle douche, and then lower it to the required point in a given time, is impossible for the average attendant, and, even with those of considerable experience, it is a delicate matter. Better results will be obtained by simple prescriptions, *e. g.:*

Hot-air bath, eight to ten minutes or to perspiration.

Circular douche, two minutes, $105^{\circ} > 90^{\circ}$ F. ($40.6^{\circ} > 32.2^{\circ}$ C.), 20 pounds.

Jet douche, one minute, $90^{\circ} > 80^{\circ}$ F. ($32.2^{\circ} > 26.7^{\circ}$ C.), 15 to 20 pounds.

Scotch douche, one-half minute, 105° and 80° F. (40.6° and 26.7° C.), 15 to 20 pounds.

Fan douche, ten seconds, 80° to 78° F. (26.7° – 25.6° C.), 15 to 20 pounds.

COLD DOUCHE

This is a single stream of water under pressure coming from a nozzle of $\frac{1}{4}$ or $\frac{1}{2}$ inch in diameter at a distance of 6 to 10 feet

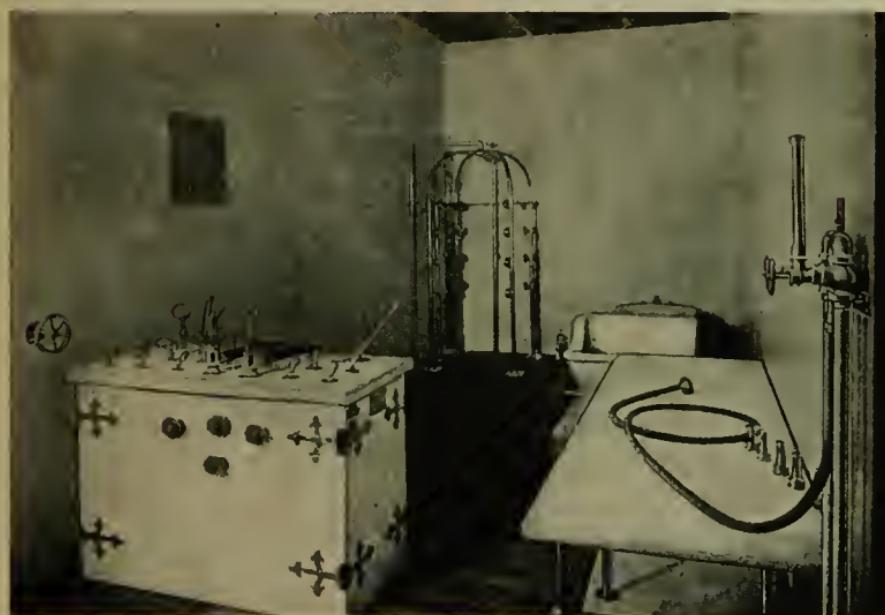


Fig. 60.—Douche room. McLean Hospital, Waverly, Mass. Marble wall of Vermont marble.

from the patient. The temperature may be regulated by valves which govern the mixing chamber in the control table, and may be graduated from a warm stream down to the coldest water supplied. It is a powerful stimulant and useful for its tonic effect after the hot-air bath and circular douche.

It is counterindicated in asthma, as paroxysms of asthmatic breathing may be induced. The sudden contraction of the pulmonary vessels restrict the area of blood subjected to oxida-

tion in the lungs, the carbonic acid is not properly eliminated, and a sense of suffocation ensues. This is corrected as reaction occurs, and the secondary effects are powerful, tissue change being highly stimulated. Fatigue gives place to renewed energy, especially if the cold applications be preceded by heat and followed by vigorous rubbing.

As a general thing, cold douches should follow hot applications, never the reverse, although alternate heat and cold are occasionally employed; in this case the terminal douche is cold.

Kneipp Water Cure.—Cold douches were the mainstay of the famous Father Sebastian Kneipp, a Bavarian priest. He and his assistants applied this usually to the lower limbs, and he also ordered his patients to walk barefoot in the morning dew on soft grass and adopt a spare diet. Many thousands of people from all over the world were treated in this manner twenty years ago with surprising results. Accompanied by suggestion and good circulation induced by this form of treatment, which included early morning exercise, a great amount of good was undoubtedly accomplished.¹

Substitute for Jet Douche.—In the absence of apparatus for the jet douche, a substitute may be adopted. The patient on rising stands in a bath-tub, and turns the two faucets so that the water will be delivered at about 100° F. (37.8 C.). A large bathing sponge is held under the faucet and then pressed against the back of the neck. This is done several times, and, the hot water having been turned off, the sponge is filled with cold water and applied to the back of the neck and spine in the same way. After a brisk rubbing, the patient partly dresses and lies down for half an hour. This may act favorably in some cases in which the ordinary plunge bath or shower is not desirable.

Uses.—Cold douches, whether locally or generally applied, preceded by some warming measure and followed by friction, are used for anemia, insomnia, and headaches. Acne of the face and thorax and a generally bad complexion are also im-

¹ Father Kneipp published a volume entitled *Mon Testament*, embodying the principles of his treatment, *Ma Cure d'Eau*, 1891.

proved by these measures, as are also chronic constipation with muddy complexion, general auto-intoxication, and general mal-nutrition.

Spinal Douche.—Charcot used the spinal douche at a low temperature, 45° to 60° F. (72°–15.6° C.), in cases of hys-



Fig. 61.—Spinal douche—Charcot douche (Gant).

teria with marked benefit. It was never applied except to a limited portion of the spine, and hence no general depression occurred and the reaction was easy. The limited spinal douche at 20 or 30 pounds' pressure and at low temperature is sometimes referred to under Charcot's name.

ALTERNATING HOT AND COLD DOUCHES

This form of douche, for some unknown reason called the Scotch douche, produces distinctly exciting effects. It is not applicable to the head or the anterior chest, but may be applied to the spine and posterior thorax and sides; to the



Fig. 62.—Abdominal Scotch or alternating hot and cold douche, the water under considerable pressure (Gant).

abdomen and to the lower extremities. With temperatures alternating between 105° and 70° F. (65.6° and 21.1 C.), or possibly a few degrees higher and lower, good results are obtained; in robust patients the extremes may reach 110° and 55° F. (43.3° and 12.8° C.) or lower.

Douches to the Head.—In applying a douche to the head it

should be, as a rule, cold or cool, without pressure, as given from a dipper or pitcher, and the duration should be only a few seconds. The immediate effect is a dilatation of the blood-vessels of the brain; if too long continued, a secondary contraction and chilling occur. It may be designated as an affusion,



Fig. 63.—Hepatic douche (Gant).

and is used in connection with the Brand bath or drip sheet, and always at a slightly lower temperature, and repeated once or twice.

It may be applied in mental disease, as in melancholia and hypochondria. In cases of insomnia, mania, and paresis the water should not be less than 80° F. (26.7° C.) or more than 95°

F. (35° C.). Douches to the bare head are generally inapplicable to women on account of the difficulty of drying the hair.



Fig. 64.—Gant's perineal (ascending) douche.

For women the full bath or the spinal douche is to be preferred. Great caution should be exercised in any case.

THE RAIN DOUCHE

This valuable form of douche may be used for general purposes of ablution and, for many reasons besides those of economy, is used as a substitute for the general cleansing tub-bath. It is a common adjunct of public baths under the name of shower-bath (see p. 375). It is easily attached to the household bathtub for domestic purposes and is always included in the fixtures

used for giving the circular or needle bath. In this apparatus American manufacturers set the rose for the rain douche slightly behind the head of the standing bather and at a moderate angle, so that, instead of descending vertically on the head, the water may strike the back of the neck and shoulders after the head has been sufficiently wet. This allows the use of soap and a general ablution if this be required.



Fig. 65.—Rain douche.

The pressure and temperature of the descending or rain douche may be regulated by the bathing attendant, who stands at the control table, but in the public baths and in private use the temperature is usually adjusted by the patient or attendant by means of a valve convenient to the bather, who is thus enabled to employ colder water toward the end of the bath. The pressure does not need to be very great. Usually the city pressure is sufficient. The high pressures used in the needle

or circular douche are not required for the head, and if over 30 pounds to the square inch may do harm.

The rain douche or shower is always used after the shampoo in the Turkish bath and before the plunge. It is highly desirable before entering a swimming pool, in which case it should be warmer than the pool. It is also excellent as an after-shower



Fig. 66.—Mott combination "Securo" shampoo mixing valve. Tilting basin with brackets and stops (J. L. Mott Iron Works).

at a lower temperature than the pool when that is kept at from 70° to 78° F. (21.1° – 25.6° C.).

Many also like the rain bath of soft fresh water after sea-bathing; but, as has been noted further on, the transition from the cold water of the ocean to the fresh water of higher temperature is thermometrically irrational, and, therefore, the author does not approve of it. Much of the benefit of sea-bathing may be lost in this way, and the subsequent warm fresh shower

should not be used unless the bather is chilled with too long an exposure and fails to react. No harm, as a rule, can result from the little sea salt that clings to the skin after the use of a rough towel.

Every douche should be preceded by wetting the head with cold water and applying to it a towel wet in cold water.

Effects.—The rain douche, in brief applications and moderately low temperatures, causes a vigorous nerve stimulation and strong reaction. It accelerates metabolism and promotes the circulation. It is especially applicable in nervous affections, functional disorders, such as neurasthenia and hysteria, neuralgias, paresis, disorders of nutrition, weak circulation when no organic changes in the heart and blood-vessels are present. It has a marked influence on heat production and sweat formation, for which applications of longer duration are required. Tepid and warm rain baths have a sedative action and are applicable, therefore, in very sensitive neurasthenic and hysterical subjects.

By changing the temperature, now to warmer and now to colder, then quite warm, rain douches accomplish much in torpid conditions and enforce a good reaction, especially in anemia and chlorosis, because they bring about a good nervous stimulation without heat abstraction. They also favor the action of the skin and relieve many of its diseases.

In hysterical cases, and especially where there is an hysterical back to deal with, rain douches of indifferent temperatures, followed by a Scotch douche, 105° and 80° F. (40.6° and 26.7° C.), may be used. The pressure of the Scotch douche should not be more than 10 or 12 pounds at first, or with just sufficient force for the jet to reach the patient. On successive applications the force of the douche may be increased. Duration, fifteen to twenty seconds.

FAN DOUCHE

This is a modification of the jet douche. The thumb is placed over the nozzle delivering the jet, breaking it into a fan-shaped stream. This douche is usually cool or cold and is a terminal measure.

FILIFORM DOUCHE

This is an extremely small douche driven at high pressure, as much as 60 pounds to the square inch or even higher (4 to 5 atmospheres). When applied to the skin it acts as a powerful counterirritant and stimulant, and in this respect its mechanical properties supersede its temperature. The filiform douche bears the same relation to other douches of larger volume that electric currents of high tension bear to the ordinary galvanic current. It is useful in sciatica and other neuralgias. The duration is short, from one-half to two minutes.

The **steam douche** is applied by means of a similar apparatus, but carrying live steam.

THE PERINEAL OR ASCENDING DOUCHE

All completely equipped douche-rooms are provided with a fixture in the floor or between the slats of the flooring for this

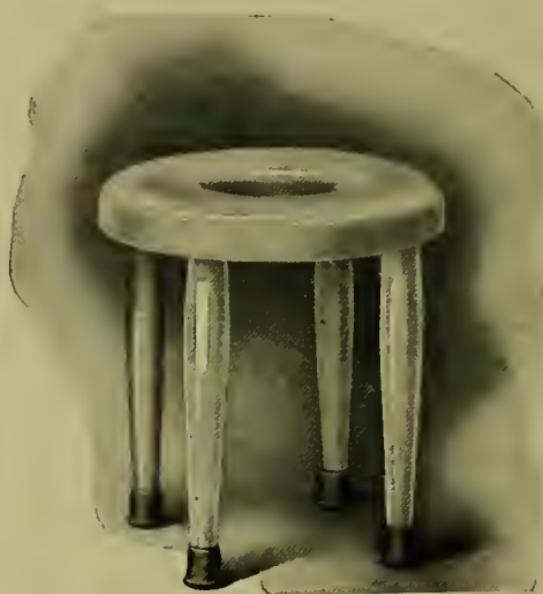


Fig. 67.—White celluloid enameled perineal stool with opening in center for use in connection with perineal douche (J. L. Mott Iron Works). (See also p. 258.)

douche. It is generally regulated from the control table by a special valve, and the temperature and the pressure are con-

trolled just as in the case of other douches. The patient sits upon a stool with a hollow or circular seat and receives the douche upon the perineum. The usual form is that of a single jet, about $\frac{1}{2}$ inch in diameter, but it may take the form of a spray. The temperatures employed are usually comparatively low, 60° to 80° F. (15.6° – 26.7° C.), in order to overcome weakness of the bladder, chronic proctitis, sexual depression, and psychic impotence. It is well suited for hemorrhoids.

The duration of this douche may vary from three to ten minutes, according to individual requirements. It has some advantage over the sitz-bath, in that a certain amount of mechanical force is applied; this force should be sufficient to raise the column of water about 30 to 40 inches from the floor.

AIX DOUCHE; MASSAGE DOUCHE

This is a combination of the douche with vigorous massage. As practised for over one hundred years at Aix-les-Bains, it requires the services of two attendants, both being provided with a flexible tube or hose, bringing water at two different pressures.

The two springs at Aix-les-Bains, the alum spring and the sulphur spring, are about 100 yards apart, and have almost the same chemical composition. They are waters of small mineralization, about 35 grains per gallon, alum not being a constituent, and the amount of sulphur being very small; the combined flow is about 6,000,000 liters, or 1,200,000 gallons in twenty-four hours. The temperature is 113° F. (45° C.). Water from another spring, at 52° F. (11.1° C.), serves to graduate the temperature of the douche and the baths.

The author visited Aix-les-Bains in 1910, and was favorably impressed by the methods of treatment used in that resort.

The Aix douche is described by Dr. Jean Dardel,¹ of Aix-les-Bains, as follows:

"The *douche* of Aix is a combination of the douche and

¹ International Clinics, vol. ii, 17th series, 1907. See also The Spas of Aix-les-Bains and Marliez, by Francis Bertier, J. and A. Churchill, London, 1877.

massage, sometimes called *douche-massage*. This douche-massage constitutes the real specialty of Aix-les-Bains. This is not a douche, according to the usual signification of the word douche, for the term implies a colder and a more rapid operation. Nor is it simply a massage. It is a special operation per-



Fig. 68.—Douche-massage, Aix-les-Bains.

formed by a *petrissage*, or kneading of the muscles, the patient receiving at the same time a general and abundant douche of the thermal sulphurous water.

"The douche is given in rectangular chambers, each chamber having a dressing-room. Some of these chambers are completely closed, while others are open toward the ceiling. This

disposition allows the escape of the vapor, and at the same time avoids the overheating of the atmosphere in the room where the douche is taken.

"In each cabin where the douche is administered, the temperature of the water varies from 57.2° to 109.4° F. (14°-43° C.), and one can have a cold, a warm, or a tepid douche, according to his need or pleasure. But the division called the central division does not admit of any but the thermal water douche.

"The conduits which bring the waters, either mineral or cold, run into vessels fixed in the wall, in which the waters are mixed.



Fig. 69.—"Etablissement Thermal," Aix-les-Bains.

One of these vessels is a reservoir placed at 1.65 meters above ground. The mixing of the waters takes place in the open air, so that the pressure does not vary. This mixed water is destined to flow over the back and the upper parts of the body.

"The second vessel for mixing the waters is a closed box or copper cistern, into which the hot and cold waters flow. This mixed water serves to flow over the different limbs of the invalid. In this second reservoir for mixing the waters the water preserves its full pressure, which varies according to the different stories of the building (14, 9, or 6 meters).

"The invalid is seated upon a wooden chair, about 1 foot high, furnished with one arm about two-thirds of a foot high, upon which he leans; he rests his feet upon a wooden stool. One of the *doucheurs* places himself before the patient, holding under his arm one of the tubes—the one which contains both the hot and the cold water. He directs the water over the different parts of the limbs of his patient, at the same time frictioning and petrissing the muscles; and, according to the case, moving the joints about. The second *doucheur* keeps behind the invalid,



Fig. 70.—Going to the baths, Aix-les-Bains.

holding the tube which contains the water from the free-air vessel. By imperceptible movements he waters the shoulders and the back of the invalid, massaging at the same time the muscles of the neck, back, or trunk. During the whole time of this massaging of the different parts of the body the invalid is inundated, so to speak, with thermal waters.

"After a time, which varies according to medical advice, the patient leaves his chair and stretches at full length on an inclined table for massaging. The *doucheur*, still holding his tube of mineral water, places himself behind the invalid, and proceeds

to the massaging of the muscular masses of the back, and of the back parts of the thighs and legs. Massage of the back can also be performed by placing the invalid upon his chair in an inclined position, his hands leaning on the arm of the chair. Certain invalids, who cannot move without great discomfort, are brought



Fig. 71.—Bathing pool (piscine), Aix-les-Bains.

to the douche upon a camp-bed, which they are not obliged to leave during the douche, and thus avoid every painful movement.

"The massage being terminated, the patient places himself in a corner of the cabin, and there receives the douche in full, in a shower, or in a sprinkle, which is the most important of all. The last part is extremely important, and the doctors know how to obtain different results, from the use of a broken jet or from a

full jet, the jet falling on the patient like a spout, throwing out in full force the water upon him, or coming gently upon him like a shower of rain, either in cold or in warm showers or in Scotch shower-baths or douches.

" The douche-massage being completed, the patient is dried, wrapped up in a flannel dressing-gown, and then covered with a woolen rug, put into a sedan-chair, and carried to his hotel. He is put into bed thus wrapped up, and after twenty minutes or so of heavy perspiration, he is uncovered and again dried, and wiped by the man whose duty it is to help him to get out of the *maillot*, or wraps. This done, the douche-massage is finished.

" Occasionally the patient dresses himself at the end of his douche and goes out on foot, to induce perspiration either by exercise or by returning to his bed. But it is preferable to return in the *maillot*, well wrapped up, in the sedan-chair. Formerly this method was used exclusively. Such is the most usual form of the douche of Aix-les-Bains, but its administration may be subjected to certain variations.

" When the douche is given by a single doucheur the preparation is the same as when there are two doucheurs. The patient is seated as before on a low chair. The doucheur, holding the tube which brings the water from the reservoir, pours it over the different limbs and the muscular parts of the body. The tube, which comes from a box containing the mixtures of water kept in the open air, is fixed to a particular instrument which ends with a watering apparatus, the water from which flows over the patient during the whole operation.

" The local douche is given in a chamber or cabin divided into two compartments by a wooden partition, which has two holes bored through it so as to admit either the arm or the leg. The patient is seated on a low chair and passes his arm or his leg, as the case may be, through the orifice in the partition. The doucheur is in the other compartment, and he proceeds to massage the arm or the leg, or the affected part of the arm or leg, the thermal water flowing all the time, from a flexible tube connected with the reservoir, over the member under treatment.

"Corbin Douche."—In certain cases the chair used for the massage can be replaced by a particular stool, and under this stool is fixed a crooked tube which is joined to one of the reservoirs of the mineral waters and which ends in a watering spout. The jet of thermal water strikes the region of the perineum, and is of great use in the treatment of many cases of hemorrhoids and of enlarged prostate. The name of *Corbin* has been given to this particular douche.

"The vapor or steam baths, both local and general, are given in *bouillons*, or in the division of the *Berthollet apparatus*.

"The name of *bouillons* has been given to the cabinets which are connected with a certain number of douches. The mineral water rushes out bubbling from the apparatus which is used to produce this bubbling or boiling, and is converted into a pulverous, vaporous steam of 104° to 109.4° F. (40°–43° C.) of heat. This vapor produces a rapid and abundant perspiration. The patient remains in this cabinet from three to ten minutes, the vapor bath being at once followed by a douche.

"Berthollet Apparatus."—The apparatus called *Berthollet* constitutes another peculiarity of Aix. The daily use of this bath requires a consumption of 1,680,000 liters of water. A special arrangement of the Berthollet bath produces a mixture of air and vapor from the mineral water at a temperature of 111.2° F. (44° C.). This mixture is driven back into a receptacle of cast-iron, situated in the cabinet where the treatment is taken. The apparatus, which varies according to the part of the body to be treated, is fixed to the receptacle containing the vaporous steam, and is then directed to the affected parts, whether leg, arm, back, or shoulder. These different members of the body are first wrapped up in an impermeable cloth, so that the currents of damp hot air fall directly on the parts to be treated. The treatment lasts about twenty minutes.

"The Berthollet bath can also be taken in what is called a *box-bath*. The vapor comes under the box, so that the whole body, except the head, is submitted to the action of the heat.

"To the Berthollet is joined the *humage*. In the cabinet of

this name are placed four *tambours* or *cunes*, low down, furnished with flexible tubes. The patient himself directs the current of air saturated with vapor to his throat, his nostrils, his ears, his face, or his hands.

"The *baths* situated on the first floor are fed with cold and thermal water. Here the bathing is perfectly good and salutary. A certain number of the baths are connected with the douche cabinets, so that the bathing can be effected before or after the douche, without dressing.

"The baths called *refrigerating* have eight cabinets in which baths may be taken in pure mineral water. The thermal water flows here as in all the other baths, but it is refrigerated gradually, and the cool temperature is due to a cool serpentine vessel through which the water passes before reaching the bath. This mineralization is employed in certain *diathèsique manifestations* (morbid diathesis) and in *dermatoses* (skin diseases).

"A small tube inserted in the tube of the thermal water serves to give the pressure 113° F. (45° C.) to the bath called *irrigation*. It is a mediate douche resembling the *sous-marine douche* of Plombières. The patient, after he has gotten into the bath, directs the water-jet upon his body or on the affected part, either in full jet or in part; and, according to the layer of water between, the jet is more or less strong. The result of this simple process is wonderful. This last arrangement permits one to direct with great ease the mediate-jet on to the abdomen, and unites the effects of heat and gentle massage.

"The *piscines* are fed by the same waters as the baths. The temperature is 95° F. (35° C.). In two piscines the temperature is lowered to 86° F. (30° C.) from 10 to 11 o'clock in the morning. From a medical point of view, the piscine is very useful, as it permits the patients in certain cases (such as traumatism and arthritis) to move about in the water, movements which are otherwise difficult to make. The patient whose articulation has been immobilized is able to move about in the water because the water bears him up. He is thus able to re-educate the movement of his limbs, and he learns again to walk.

"The physiologic action of the thermal treatment at Aix results from, or is caused by, many and divers agents. First, the physical and chemical factors are: the temperature of the water; its unctuousness; the abundance of the waters; a special electric action; its chemical composition, viz., its sulphurous contents. Second, factors resulting from the manner of applying the waters; massage; the mechanical action of the water; the action of the vapor or steam. Each of these various elements has its own peculiar action. The combination of these various procedures produces different results.

"The greater number of those who come to Aix have previously undergone various treatments, such as douches, baths, massage, and vapors. They come to ask and to look for a new treatment in the cure of Aix, which, happily, they find. This action is naturally complex.

"The treatment of Aix-les-Bains, as has been proved by experiment, lowers the *arterial tension*. The action of the treatment on the *nervous system* is stimulating as well as sedative. The effect produced depends on the manner of applying the treatment; such as temperature, duration, and frequency of the operations. We can obtain very different results according to the method employed. The thermal fever which ancient authors were so pleased to describe was only the consequence of the thermal operations too warmly and too frequently applied. That thermal fever was but a result of excessive zeal.

"*Nourishment* is influenced by the treatment, as urologic research has proved. The urine is rarefied and its toxic or poisonous power is increased. Phosphoric acid and the mineral elements generally are eliminated in smaller quantities; and at the same time we see the waste products of organic combustion, such as urea and uric acid, increase. In a word, the treatment has a mechanical action, both direct and indirect. The functions of the skin are stimulated by the flow to the periphery of blood, which is attracted by the warm water in contact with it; an abundant perspiration is produced, and an elimination is effected by this means. On the other hand, there is an acceleration of

the lymphatic circulation which favors the resolution and re-sorption of the exudates, effusions, and periarticular deposits. In a word, the diseased tissues tend to return to their normal condition.

“Indications.”—The detailed manner in which we have described the treatment at Aix, and its effects, will allow us to make a statement, rather than a long description, of the pathologic conditions which may suitably be treated by the waters of Aix-les-Bains.

“The indication of the treatment at Aix must be considered every time we wish to accelerate nutrition. We must distinguish the principal indications from the secondary ones.

“The principal indications are:

“Chronic rheumatism in all its forms.

“Rheumatism which deforms or disfigures, to which we may add the rheumatic nodes of Heberden and the rheumatoid arthritis of the English.

“Muscular pains, lumbago, torticollis, and the various pains often called muscular rheumatism.

“The sequelæ of articular rheumatism, both acute and subacute, in all its forms. The sequelæ of the various conditions called infective rheumatism.

“Gonorrhreal rheumatism.

“Asthenic gout.

“Syphilis.

“Every kind of neuralgia, and particularly sciatica.

“Peripheral neuritis.

“Chronic arthrites, joint stiffness, hydrarthroses, posttraumatic, postarthrites.

“Muscular atrophy consecutive to an inflammatory condition, a nervous affection, or trauma.

“The consequences of phlebitis.

“In addition to these affections the treatment of Aix can ameliorate other states of illness (secondary indications) connected with nutrition, but the indication is then less absolute. Massage in conjunction with the douche suits certain cases of

obesity, diabetic arthritis, and eczemas connected with the arthritic state. Hydrotherapy may be applied with benefit in most nervous affections. Many uterine maladies are relieved by copious irrigations, and the lavage is attended with great success in cases of mucous membranous enteritis.

“Counterindications.”—No invalid ought to undergo the thermal treatment during or while just recovering from an acute attack of illness. This is one of the main counterindications for the use of the treatment. Tuberculosis and serious liver and kidney complaints are obstacles to the thermal treatment. Compensated valvular lesions of the heart (rheumatic endocarditis) can derive benefit from the treatment if well looked after. But all the other cardiac complaints must abstain completely. As to cases of arteriosclerosis, the cure of Aix is not denied them; only they must be well looked after by the doctors, who should exercise judgment and tact while having full control over the treatment.

“Treatment of Syphilis.”—The thermal treatment of Aix-les-Bains is perfectly suitable for the cure of syphilis. The sulphuration of the water in itself constitutes a specific medication. It is certain that the douche combined with massage is a valuable auxiliary to the iodid and mercurial medication. The thermal treatment acts, in the first place, by its tonic effect; second, by aiding the absorptive and eliminating functions of the skin; third, by stimulating metabolism. It also favors the passage of medicaments through the organism by the successive formation of different albuminomericurials (by the absorption of the iodomercurial preparations and the elimination of the waste products). Thus the patient, a prey to an enfeebling and depressing malady, sees an amelioration of his general condition. He can also, without fear of accident, absorb a larger dose of the specific medicament, which, passing through the organism, acts potently.

“At Aix-les-Bains a specific cure for patients can be administered at different periods of the illness: old and new lesions, and most often tertiary lesions, are continually treated here. Inunc-

tion of large doses is often prescribed; we prefer, however, injections of soluble mercurial salts. For all these patients the douche of Aix-les-Bains, with the *bouillon*, the vapor baths, and the profuse sweats which result therefrom, help the action of this specific medication, and allow of the continuous administration of a sufficient dose. This medication, more than any other, requires an attentive medical attendance.

“Zander Method.”—The department of Mechanical Therapeutics is installed in a special pavilion, named the *Zander Institute*.



Fig. 72.—Leaving the baths, Aix-les-Bains.

The Zander method consists in the use of the medical gymnastics devised by Ling, for which purpose mechanical apparatus is employed. Its principle is to graduate and localize the movements, to move each joint singly, to exercise each group of muscles one after the other, while measuring exactly the extent of each movement, and the energy of each and every effort.

“In the Zander method the resistance to be overcome by the patient’s effort (which resistance is represented by the gymnast’s hand) consists in a graduated lever upon which a weight can be



moved. Compared with ordinary bodily exercise, such as sports or gymnastics, the mechanotherapeutic method offers many advantages, as it divides the work and diminishes the efforts. In the first place, during the movement the resistance accommodates itself to the natural variations of the result of muscular contraction; second, the energy of the movement is measured exactly; third, the resistance to be overcome remains fixed. It is possible to modify with exactness the energy of the move-



Fig. 73.—The Aix douche (Luke)

ment, increasing or diminishing it, as the case may be. Different kinds of apparatus have been constructed, some for active movements, some for passive movements. Some of the appliances are made for mechanical procedures, such as vibrations, percussion, and kneading; others are orthopedic instruments. In the case of all these different appliances the doctor is sure to exercise the right muscles and not to touch the others; that is, he is sure not to touch those unaffected. He knows how to apply that amount of exercise which his experience has shown

him to be the most useful; not to give more than is needed, and yet not to fall short of what is required."¹

A modified Aix douche is sometimes given with only one attendant (see page 275).

VICHY DOUCHE

The Vichy douche resembles the Aix douche. The patient lies in a recumbent position on an india-rubber air mattress, while massage is administered under a spray douche descending



Fig. 74.—Special douche-massage chair, allowing complete relaxation (bath) (Luke).

vertically from three "roses" about 2 feet above the patient. This douche is often preceded by a steam or hot-air bath to induce free perspiration. After the Vichy douche is applied for twenty minutes the circular douche or needle douche is given as a terminal measure.

COMBINED BATH, DOUCHE, AND MASSAGE

At Buxton, England, a combined bath, douche, and massage are given. The illustration shows a patient reclining in a shallow

¹ A complete equipment of the Zander apparatus is installed at the Massachusetts General Hospital, Boston, and has been purchased for use at the Virginia Hot Springs.

tub, at a convenient height for the attendant, who applies the douche with massage. The partial immersion bath has a temperature of 94° to 100° F. (34.4°–37.8° C.).

The indirect or undercurrent douche has a slightly higher temperature than the bath itself. Its temperature ranges from 98° to 104° F. (36.7°–40° C.), and the pressure about 15 pounds to the square inch. The caliber of this douche is from $\frac{1}{4}$ to $\frac{5}{16}$ inch. It is applied during the last three to five minutes of the bath to tender joints, or any affected part by holding the nozzle



Fig. 75.—Buxton massage and douche bath. This bath is filled with water at 94° to 100° F. (34.4°–37.8° C.). The patient is getting a partial immersion bath as well as douche massage.

at a variable distance, allowing the intervening water of the bath to break the force of the douche and distribute it over a greater or less area. As the affected portion improves, the direct douche may be substituted for the undercurrent method.

The douche massage, as applied at Aix, Vichy, or Buxton, is very valuable in the treatment of chronic rheumatism, gout with arthritis, also chronic muscular rheumatism.

In cases of obstinate atonic constipation special attention should be given to the liver, abdominal muscles, and colon.

PERCUSSION DOUCHE

In this douche, air and water, under high pressure, are delivered from an apparatus with a special nozzle. The stream of water is broken by the contained air, and the effect is to intensify the mechanical element of the douche. It has a highly stimulating effect, and is useful in visceral anemias and constipation.

THE PAIL DOUCHE OR PAIL-POUR

This has been referred to as a final douche in the half-bath. The water is applied in considerable quantity a few feet above



Fig. 76.—Rain and circular (needle) douche (Gant).

the bather and permitted to fall on the shoulders and back (Fig. 77). It may be at any temperature desired. It unites with the thermic action of the water a mechanical effect in ac-



Fig. 77.—Pail douche (Gant).

cordance with the height or force with which it is applied; it is a stimulating measure. One or two pails of water are usually sufficient.

HOT LUMBAR DOUCHE

A wonderful differentiation of douches has been attempted, designated as Plombière, Charcot, Fleury, spinal, lumbar, thoracic, shoulder, abdominal, sternal, epigastric, hepatic, renal, splenic, plantar douches, and so on. The hot lumbar douche may be used in treating lumbago. Claims are made that the douche over the hepatic region, at a pressure of 15 to 20 pounds and at a temperature of 65° to 75° F. (18.3°–23.9 C.) for five or ten minutes, may relieve congestion. One of the patterns of sitz bath-tubs is provided with perforations, giving a needle spray directly over the liver when the patient is seated. In this way the temperatures and pressures may be nicely adjusted.

In cases of chronic enlargement of the liver the temperature should alternate between 105° and 70° F. (40.6° and 21.1° C.); in acute congestion only the higher temperature should be used. In hepatic colic alternating temperatures may be given; but in severe cases probably better results will be obtained by the use of hot compresses, frequently repeated.

FLEURY DOUCHE

In using this douche, first a rapid general high-pressure application of cold water, 65° or 70° F. (18.3° or 21.1° C.), is made; then a strong jet at the same temperature is directed over the liver area for from ten seconds to one minute. This is followed by a shower on the epigastrium and warm water on the feet. Professors Raymond and Duchenne, of Paris, finding that this douche is not well tolerated and frequently harmful, have modified it, beginning with warm or hot water, 100° to 113° F. (37.8°–45° C.). They advise the following technic:

Begin with 100° to 102° F. (37.8°–38.9° C.); raise progressively to 113° F. (45° C.), at the same time increasing the strength of the jet. Keep at 113° F. (45° C.) until the skin becomes dark red—one-half to one minute—and then give a general cold or lukewarm douche. This is essentially an hepatic douche. It yields excellent results in hepatic congestion, hyper-

trophy, and biliary stasis; also in alcoholism, dyspepsia, chronic jaundice, etc.¹

Chronic malarial disease affecting the spleen and acute and chronic *nephritis* call for similar treatment. *Renal calculus* may be treated by very hot douches or compresses over the lumbar region. Every practitioner has seen good results from these measures. The author has never used a cold douche over the kidney, although it is claimed that it stimulates the flow of urine and relieves congestion. That the kidney can be reflexly stimulated by prolonged cold applications to the lower sternum is claimed by Beni-Barde (Kellogg). The small renal vessels are contracted, the pressure rises in the glomerules, and the urinary flow is stimulated. The author is not aware that clinical evidence supports this view, although it appears to be a rational procedure.

Good results from these douches are obtained in the treatment of *chronic rheumatism*, *gout*, and in *arthritis deformans*. Exudates or articular swellings respond to this form of hydrotherapy in connection with tub-baths, warm packs, and massage. The douche should be above the body temperature, and may be continued for five to ten minutes at a pressure of 12 to 18 pounds to the square inch. As usually given by the author the temperature used is 104° F. (40° C.) at the pressures stated. It is an excellent preliminary to a tub-bath of eight, ten, or twelve minutes at the same temperature and undoubtedly facilitates the action of the hot dry pack. This is one of the features of the treatment of rheumatism and gout at the Virginia Hot Springs, where the thermal waters have the required temperature and where a constant pressure is supplied by gravity.

THE CONTROL TABLE

The control table, which has been perfected by various makers, is a most convenient apparatus for administering all forms of douches at various pressures and at easily adjustable

¹ Journal de Physiotherapie, July 15, 1906.

temperatures (Figs. 78-80). The fittings are enclosed in a marble case. On the side where the operator stands are valves for controlling the pressure and for admitting and emptying the pipes which are enclosed. On top are the valves which control the various outlets, the jet douches, the circular douche emerging from the uprights as seen in the background,

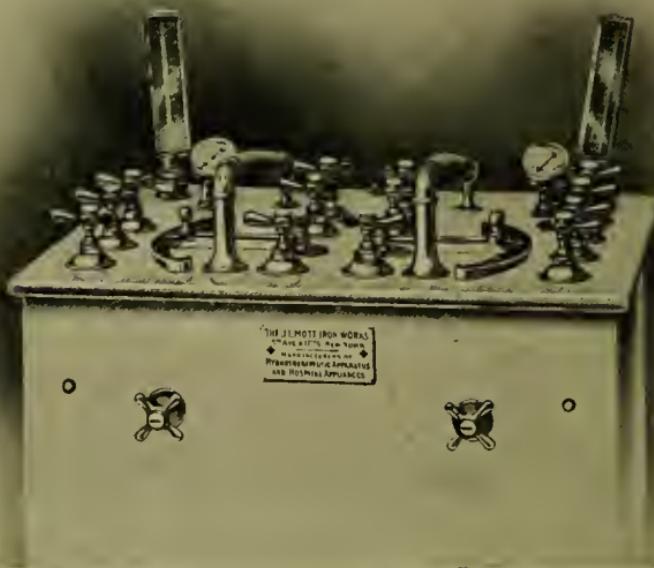


Fig. 78.—Hydriatic control table with polished Italian marble sides and top, fitted with two mixing chambers, each with temperature-regulating valve, pressure-regulating valve, thermometer, gauge and electric alarm for indicating high temperature, two special nozzles, with tips of three different sizes, quick-opening compression valves for the admission of hot, cold, and ice-water to the table, also compression valves for the control of the water to the various fixtures and douches (J. L. Mott Iron Works).

the sitz-bath, and the perineal douche. Two thermometers indicate the temperatures of the water delivered for use. Pressure gauges show the pressure employed. An electric bell is also added, so as to give warning when the temperature exceeds a given limit. This operates by the closure of a circuit when the water reaches 108° or 110° F. (42.2° or 43.3° C.).

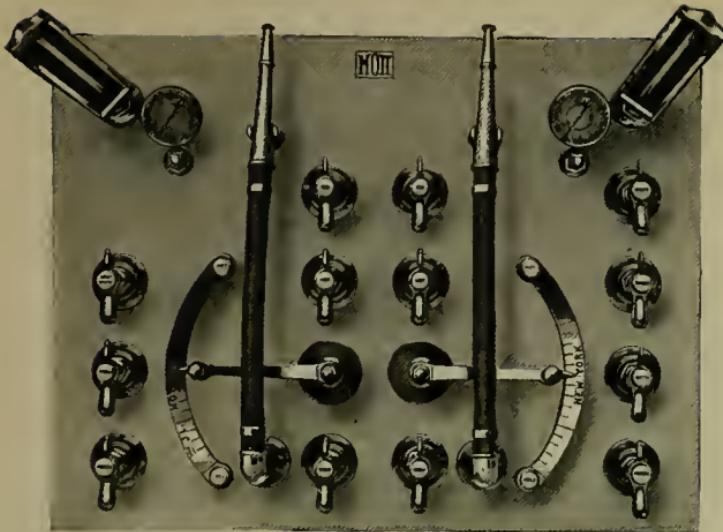


Fig. 79.—Hydriatic control table, showing arrangement of valves and temperature-regulating levers (J. L. Mott Iron Works).



Fig. 80.—Interior hydriatic room at the Medical Bath, 1709 Rittenhouse Street, Philadelphia, Pa. Showing douche table, uprights for circular and rain douche, full tub, and sitz-bath (J. L. Mott Iron Works).

The douche table is undergoing a process of evolution, and improvements are added almost every year. These relate to the

mixing chambers, the levers or handles for operating the various douches, and the valves for controlling the pressures. It is still almost too expensive for private use, but reference to the following list may prove useful to the practitioner in referring patients for treatment. The apparatus is made by J. B. Clow and Sons, Chicago; The J. L. Mott Co., of New York and Trenton, N. J;

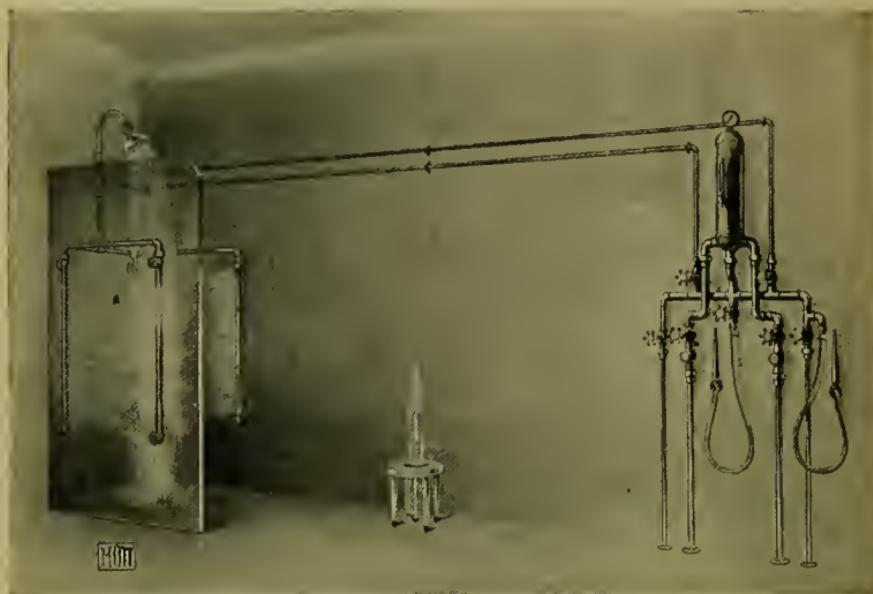


Fig. 81.—Wall apparatus; this is a very good substitute for the more expensive control table (J. L. Mott Iron Works).

The Hydrotherapeutic Apparatus Co., of New York (Frank Richter), and the L. Woolf Manufacturing Co., Chicago.

The Hydrotherapeutic Apparatus Company of New York has installed this table in the following institutions:

Connecticut Hospital for Insane.....	Middletown, Conn.
U. S. Government Hospital for Insane, St. Elizabeth.....	Washington, D. C.
Louisville Sanitarium.....	Louisville, Ky.
Manhattan State Hospital.....	Central Islip, L. I.
Danvers Lunatic Hospital.....	N. Danvers, Mass.
McLean Hospital, Massachusetts General Hospital.....	Waverly, Mass.
Dr. Channing's Sanitarium.....	Brookline, Mass.
Hydriatic Institute, J. M. Colby.....	Boston, Mass.
New England Hospital for Women and Children.....	Boston, Mass.
House of the Good Samaritan.....	Brookline, Mass.

Medical Baths, Farragut Building.....	Boston, Mass.
Bridgewater Normal School.....	Bridgewater, Mass.
Greylock Rest.....	North Adams, Mass.
Lakewood Hotel.....	Lakewood, N. J.
The Agnew Hotel (2).....	Atlantic City, N. J.
Hydriatic Institute, 635 Park Ave.....	New York City.
Riverside Baths, Rain Baths, and Hydriatic Department.....	New York City.
Dr. Parson's Private Home for Nervous Invalids.....	Greenmont, N. Y.
Dr. Bond's House for Nervous Cases and Habit Cases.....	Yonkers, N. Y.
The Loomis Sanitarium for Consumptives.....	Liberty, N. Y.
St. Lawrence State Hospital.....	Ogdensburg, N. Y.
Manhattan State Hospital, West.....	Ward's Island, N. Y.
Manhattan State Hospital, East.....	Ward's Island, N. Y.
St. Vincent's Retreat.....	Harrison, N. Y.
Binghamton State Hospital.....	Binghamton, N. Y.
Rochester State Hospital.....	Rochester, N. Y.
Hudson River State Hospital.....	Poughkeepsie, N. Y.
German Hospital, Girard Ave.....	Philadelphia, Pa.
Orthopedic Hospital and Infirmary for Nervous Diseases.....	Philadelphia, Pa.
Philadelphia General Hospital (Blockley).....	Philadelphia, Pa.
Jefferson Hospital.....	Philadelphia, Pa.
Pennsylvania Orthopedic Institute, 1711 Green St.....	Philadelphia, Pa.
Butler Hospital (2).....	Providence, R. I.
The Homestead (2).....	Hot Springs, Va.
New Milwaukee Sanitarium.....	Wauwatosa, Wis.
Sheppard and Pratt Hospital.....	Towson, Md.
Vanderbilt Clinic.....	New York City.
The Plaza.....	New York City.
The Poinciana.....	Palm Beach, Fla.

The following are some institutions in which J. B. Clow's hydrotherapeutic apparatus is installed:

Massillon State Hospital.....	Massillon, Ohio.
Dayton State Hospital.....	Dayton, Ohio.
Cleveland State Hospital.....	Cleveland, Ohio.
Columbus State Hospital.....	Columbus, Ohio.
Hotel Chamberlin.....	Fort Monroe, Va.
Buffalo State Hospital.....	Buffalo, N. Y.
State Hospital for Insane.....	Warren, Pa.
Philadelphia General Hospital.....	Philadelphia, Pa.
South Dakota Hospital for the Insane.....	Yankton, So. Dak.
Danvers State Hospital.....	Hawthorne, Mass.
Livermore Sanitarium.....	Livermore, Cal.
Mendocino State Hospital.....	Ukiah, Cal.
Government Hospital for the Insane.....	Washington, D. C.
Psychopathic Ward, University Hospital.....	Ann Arbor, Mich.

Department for Insane, Cook County Institutions.....	Dunning, Ill.
Eastern Illinois Hospital for Insane.....	Kankakee, Ill.
San Ambrosia Hospital.....	Cuba.
Mercedes Hospital.....	Cuba.
Centro Asturiano.....	Cuba.

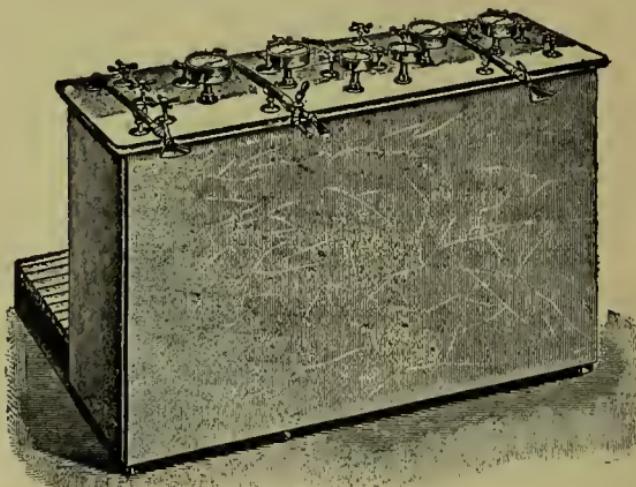


Fig. 82.—German model of control or douche table.

Partial list of institutions where the J. L. Mott Co.'s hydro-therapeutic equipments are installed:

Buffalo State Hospital.....	Buffalo, N. Y.
Glockner Sanitarium.....	Colorado Springs, Colo.
Mendocino State Hospital.....	Ukiah, Cal.
Napa State Hospital for Insane.....	Napa, Cal.
Pennsylvania State Lunatic Hospital.....	Harrisburg, Pa.
Southern Pacific Co's. Hospital.....	San Francisco, Cal.
State Hospital for Insane.....	Cherokee, Iowa.
State Hospital for Insane.....	Independence, Iowa.
State Hospital for Insane.....	Mt. Pleasant, Iowa.
Medical Baths.....	1707 Rittenhouse Street, Philadelphia, Pa.
St. Francis Hotel.....	San Francisco, Cal.
Charlotte Sanitarium.....	Charlotte, N. C.
St. Mary's Hospital.....	Pueblo, Col.
Michael Reese Hospital.....	Chicago, Ill.
New Navy Hospital.....	Washington, D. C.
Piedmont Sanitarium.....	Atlanta, Ga.
Rochester State Hospital.....	Rochester, Minn.
South Side Hospital.....	Pittsburg, Pa.

State Insane Asylum	Jackson, La.
State Hospital.....	Patten, Cal.
Dr. Adler's Sanatorium.....	San Francisco, Cal.
Cayuga Lake House	Sheldrake Springs, N. Y.
Medical Bath Establishment.....	New York City.
Oliver Building	Pittsburg, Pa.
Rockefeller Institute for Medical Research.....	New York City.
St. Francis Sanitarium.....	Denville, N. J.
The Royal Victoria Hospital.....	Montreal, Canada.
Lancaster General Hospital.....	Lancaster, Pa.
State Hospital for Insane.....	Warren, Pa.
London Insane Asylum	Ontario, Canada.

AFFUSIONS

These are used in connection with the half-bath, the Brand bath, or as an independent measure. They are decidedly stimulating and hence are valuable to rouse the unconscious patient. In cases of sunstroke they are remarkably successful. The patient, stripped or covered with a sheet, is placed on a cot protected by rubber. Basins of very cold water are then forcibly dashed on the patient from a distance of several feet. In severe cases a small stream may be allowed for a few moments to fall on his forehead. This is to be repeated every two or three minutes until his temperature falls to 103° or 104° F. (39.4° or 40° C.), when the patient is wrapped in blankets and surrounded with hot bottles. This latter is a complementary feature of the affusion, for sweating will probably ensue after a short interval in the warm pack; it is the restoration of this function which saves the patient.

CONTINUOUS BATHS

THE WARM FULL BATH

A large tub is filled three-quarters full of water at 95° to 100° F. (35° - 37.8° C.), in which the patient is fully immersed, first having his head covered with a cloth wet in cold water. The room should be at a temperature of about 80° F. (26.7° C.) and means should be at hand for maintaining the water at its initial degree of heat, for this bath is usually prolonged to ten, fifteen,

or twenty minutes or more, as required. Indeed, the duration of the bath has been extended by Hebra, Zuschlag, and others to days and even months, the patients, some of whom suffered from extensive burns, bed-sores, pemphigus and other skin diseases, existing in the continuous bath for remarkably long periods.¹ If continued for several hours, the patient may sleep



Fig. 83.—Porcelain-enamelled iron roll-rim continuous bath with automatic regulator (J. L. Mott Iron Works).

in the bath, but he naturally requires constant attendance, special lifting apparatus, and electric and other appliances for maintaining a constant temperature. For surgical and dermatologic purposes 100° F. (37.8° C.) is considered best.

¹ One of Hebra's patients lived in a bath for over one year and is said to have gained 14 pounds. See also p. 169.

Mutton suet, lanolin, or petrolatum applied thoroughly to the skin protects it from puckering and peeling.

Research by Dr. Achilles Rose in the history of the continuous bath as a therapeutic measure shows that its introduction has been ascribed to two German surgeons, Fritz and von Walther, who lived during the latter part of the eighteenth and the first quarter of the nineteenth centuries; others ascribe it to Baude-locque, the great obstetrician of the time of Napoleon I. Baude-locque made use of it in peritonitis. His method was revived



Fig. 84.—Porcelain-enamelled iron roll-rim continuous baths (J. L. Mott Iron Works).

by Noeggerath in the German Hospital of New York, but abandoned again after Noeggerath's departure.

The first who used the continuous bath in surgery seems to have been Paulus of Ægina, who lived in the seventh century under the reign of Heraclius, the Byzantine emperor. Paulus had patients, operated on for hernia, especially children, submerged in warm water for seven consecutive days in order to prevent inflammatory symptoms.

All these early advocates of the continuous bath, beginning

with Paulus of Ægina, and later on Stromeyer and Langenbeck, in the explanation of the effects of the continuous bath pronounced—although they did not say the name—antiseptic principles. All who have had experience with it will confess that it is still the most reliable antiseptic in extensive burns.

Dr. Riess, of Berlin, thirty-five years ago, and, later, Dr. James Barr, of Liverpool, used the continuous bath extensively in typhoid fever and various internal diseases, but for a long



Fig. 85.—Interior of room for continuous baths (J. L. Mott Iron Works).

time it never, excepting in mental cases, obtained very wide recognition outside of the dermatologic clinics of Hamburg, Berlin, and Vienna (see p. 208).

Indications.—In formidable diseases, like pemphigus, Kaposi shows that it relieves the pain, reduces fever, and enables the patient to pass safely through the period of eruption during which he otherwise might have succumbed.¹

¹ Baruch, Hydrotherapy, 2d ed., p. 223.

Prolonged warm baths are suitable for cases with bed-sores, compression myelitis, locomotor ataxia, and paraplegia with paralysis of the bladder and bowels, inoperable cancer of the urogenital tract, obstinate cases of sciatica, and muscular and articular rheumatism. They have been advocated for chronic meningitis, hemiplegic contractures, and general hyperesthesia.

Warm baths of short duration are valuable in all febrile affections in infants and young children, in cerebrospinal meningitis,¹ in acute mania, and other excited nervous conditions. They exert a decidedly corrective, calming effect, the pulse becoming softer and less frequent, and the respiration falling in rate. The peripheral arteries are dilated and peripheral sensibility is blunted. Friction and other movements are not generally required in the warm bath.

In violent cases the hammock has been used to envelop the body while subjected to the continuous bath. This has been used successfully at the J. Hood Wright Memorial Hospital, New York, and in the Manhattan State Hospital. Cases of chronic meningitis with violent delirium may be safely treated in this way and better than in a straight-jacket. The late Dr. E. C. Dent, of New York, was the first in the United States to use this bath in insanity.

Cases of atheroma, angina pectoris, and other cardiac cases are not proper subjects for the warm bath.

Warm baths of half an hour's duration are very useful in amenorrhea and dysmenorrhea. In the latter case the temperature may be raised to 110° F. (43.3° C.). (See p. 221.)

HOT-WATER BATHING

Hot-water baths, between 104° and 115° F. (40° and 46.1° C.), vary in their effect according to their temperature and duration. It usually requires a gentle graduation in successive baths to withstand baths of 105° F. (40.6° C.) or over, and people vary greatly in their sensitiveness to hot water. Different

¹ See page 87.

parts of the body vary in this respect; the feet, for instance, being much more sensitive than the hands.

The Japanese practice hot-water bathing more than any other people. It is said that they commonly take five baths a day and usually have the water at from 113° to 128° F. (45° - 53.3° C.).¹ The head is bathed in hot water before entering the bath, which is prepared in wooden tubs, a common sight



Fig. 86.—Kusatsu Hot Springs, No. 1, inside the bath-house for men. The water is from 130° to 160° F. (54.4° - 71.1° C.), and would scald anyone. By splashing these boards, the water in an hour is reduced to 120° F. (46.8° C.), when patients can safely enter, though even then they shrink from the almost intolerable heat. The water might be cooled by pouring in cold water, but this would spoil the medicinal qualities.

in Japan, where, in Tokio alone, upward of 400,000 hot baths are given daily. The temperature of the body rises to about 104° F. (40° C.) in the course of six to eight minutes, but returns to normal in about half an hour. Cold affusions are applied after the bath. This custom is common to all classes of Japanese. A porter with his load may become fatigued to the point of exhaustion; he drops it for ten minutes while he

¹ L. Hill, Brit. Med. Jour., February 2, 1907.



Fig. 87.—Kusatsu, No. 2. The patients have to pour hot water over their heads one hundred times before entering, in order to prevent bad effects. In this illustration they are dressed for the sake of the picture. Generally there is no such display of propriety, but just the reverse.

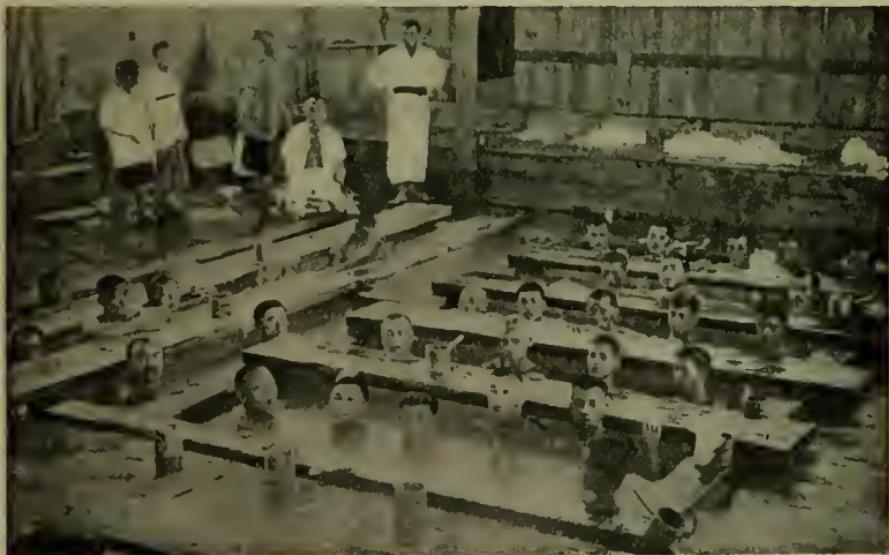


Fig. 88.—Kusatsu, No. 3. They all get in together at the command of the bath-master, and endure, as best they can, the semiscalding for three or four minutes, and when the time is announced for exit, they get out much faster than they got in.

takes a hot bath at some public bath-house, emerges refreshed and strengthened, and goes on his way rejoicing.

Warm baths have more advocates of late than formerly. The time-honored English practice of the morning cold-water bath and the popularity of sea-water bathing during the summer at all coast resorts possibly accounts for the neglect of the warm bath. Of course, the absence of bath-tubs and of hot water in summer, especially when gas ranges are used for cooking, are factors. In India the English discovered long ago that they must modify their bathing habits. Those who gave up their



Fig. 89.—Kusatsu Hot Springs, between the volcanoes Asama and Shirane. The peak of Shirane appears in the distance, where a crater lake is being made. The exterior of the bath-house whose interior is shown in Figs. 86-88. Hundreds of people afflicted with syphilis and leprosy gather at this famous hot spring.

accustomed morning cold plunge and substituted a warm bath found themselves in better condition to stand the climate than those who adhered to the use of the cold bath. There was less nerve exhaustion because there was less demand on the heat-producing functions. On the other hand, the cold bath stimulates the heat centers to great activity. If it were not so, none of us could withstand the chill of the ocean. Surf-bathing would be impossible; the blood would not seek the periphery after the first shock.

THE TURKISH BATH (DIAPHORETIC)

Well-equipped establishments are found in every large city. The objects to be attained by the Turkish bath are various. As a hygienic measure the public employs it extensively without medical advice and usually with decided benefit. Its effects are cleansing, refreshing, and stimulating to the circulation. It hastens recovery from the effects of alcoholic excesses better than any other procedure. It favors elimination through the lungs and the skin, and tends slightly to reduce excessive weight.



Fig. 90.—The calidarium. Turkish bath (Luke).

After disrobing, the patient places a loin cloth about the body, takes a drink of water, either hot or cold, and enters a room with dry air at a temperature of 110° to 130° F. (43.3° – 54.4° C.). In ten or fifteen minutes perspiration appears. Superficial massage is then employed to induce a greater degree of perspiration, and sometimes a hot foot-bath, hot spray, or hot full bath is given. After perspiration is established the patient enters a room at 150° to 200° F. (65.6° – 93.3° C.) for a few

minutes or until perspiration is very free. The next procedure is a vigorous rubbing with bare hands, followed by a soap shampoo, the subject lying on a marble slab. In the shampooing process the bathers use the loofah, or Egyptian fibrous sponge.

Next the patient takes a cold douche at 60° F. (15.6° C.) or, if perspiration be still rather free, he should have a rain douche, the temperature being reduced in from one to three minutes from 85° to 75° or 60° F. (29.4°–23.9° or 15.6° C.). The next step is the swimming bath with water at about 60° F. (15.6° C.),



Fig. 91.—The cooling room. Turkish bath (Luke).

or the patient may lie down until the skin is dry and the pulse is normal. A cup of coffee or a cigarette or two may be allowed in suitable cases. Lighting a cigarette during an alcohol rub caused a serious accident recently in a Turkish bath establishment in Philadelphia. The alcohol when applied to the body took fire, with the result that the bather had to be sent to the hospital.

The great stimulus to the sweat glands is the marked feature of the bath, and the secretion is increased tenfold during the

hour's treatment. By as much as the blood is drawn to the surface of the body, by so much are the liver, spleen, stomach, and intestines relieved of any tendency to stasis.

The inhalation of hot air stimulates the secretions of the pulmonary mucous membrane, and through the lungs and the skin several pounds of fluid may be lost. If drink is restricted, the loss is naturally greater than when fluids are taken. Hence



Fig. 92.—The shampoo, showing use of Clow shampoo spray and temperature-indicating handle.

it is that Turkish baths are sometimes used for the reduction of weight. They are not very effective unless prolonged for an hour, and many people who are corpulent are not strong enough to take such baths at frequent intervals.

If Turkish baths are taken regularly, one should purchase a loofah with a linen tag, so that it may be reserved for his exclusive use.

Indications for the Turkish Bath.—This bath is an excellent cleansing process and, taken at moderate intervals, is a good sanitary measure. In all large cities and in many clubs and sanatoria Turkish baths are found. It is generally remarked that the attendants maintain a good standard of health and do not seem to be exhausted or reduced by their labors in the humid air of the baths. Their skin is usually the pink of perfection.

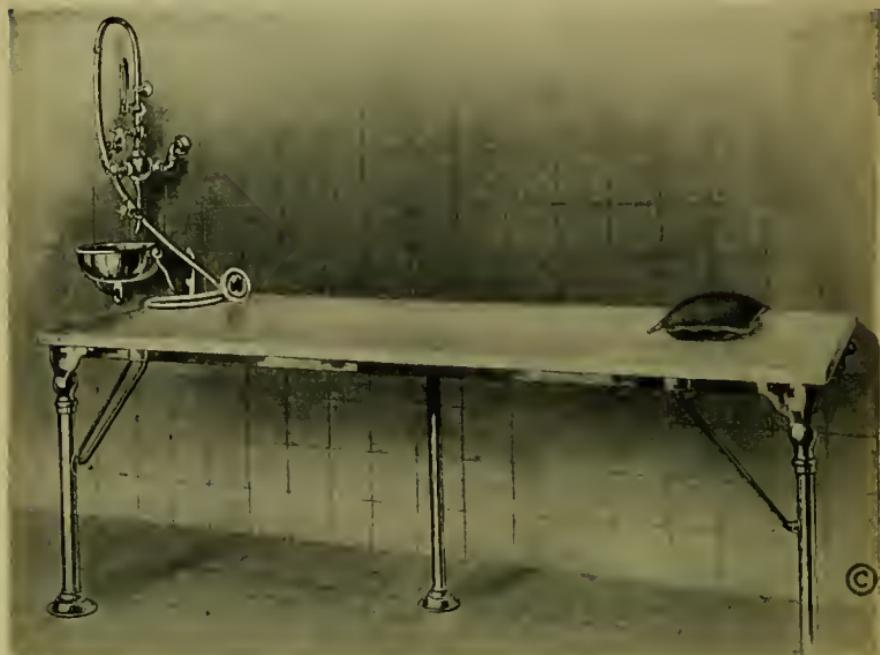


Fig. 93.—Clow's Italian marble shampoo table.

In any case of acute pharyngitis in which the surface feels raw or scraped, the Turkish bath gives relief, as it does also in cases of suppression of menstruation from cold. In the treatment of obesity, alcoholic habit, diabetes, chronic dyspepsia, and the gout of corpulent persons it is also beneficial. Among syphilitics, neurasthenics, and insane patients there are many who would be much better for Turkish baths; and selected cases of neuritis and chronic myelitis show much improvement when treated in this manner. For anemia and chlorosis they are admirable. In ordering Turkish baths for gouty patients it

should be remembered that heat will generally bring on acute symptoms in the affected joints.¹

Counterindications for the Turkish Bath.—In all cases of cardiac dilatation, cardiac asthma, tachycardia, arteriosclerosis, cases with high blood-pressure, congestion of the lungs, chronic bronchitis with emphysema, and exophthalmic goiter, this bath should be avoided.

Whenever in cases of organic heart disease there is deficient or failing compensation, these baths may do harm. While some cases of nephritis are benefited, care must be exercised and the patient be under competent observation during their use. In advanced Bright's disease the Turkish bath is positively counterindicated.²

The Turkish bath is likewise counterindicated in skin diseases accompanied by eruptions on account of the excessive congestion of the skin induced; vapor or Russian baths are preferable. They are also to be avoided in cases with a history of apoplexy and in most pulmonary diseases.

Objections to Turkish Bath.—There are a great many objections to the Turkish bath. In the first place, the air in these establishments is necessarily hot and usually vitiated. The hot rooms retain much of the effete matter excreted by the different bathers and attendants. In this respect they are decidedly more objectionable than places where the heating process is accomplished by means of hot-air cabinets or electric-light cabinets. The latter are far preferable and secure a better eliminant effect without compelling the bather to breathe bad air. The system of tonic hydrotherapy described on pages 252 and 253 undoubtedly favors greater oxidation by enhancing the oxygen-carrying power of the blood; it leaves the body in a fresher and more resistant state, thus enabling the bather to return more promptly to his home with less danger of taking cold. Of course, in the Turkish bath the final cold plunge provides in great measure against this latter danger.

¹ See p. 122.

² See Winternitz, System of Physiologic Therapeutics, vol. ix, pp. 262-267.

Dr. Hobart A. Hare gives some good advice as to the Turkish bath as follows:

"At the present time there can be no doubt that a considerable number of persons are actually damaged by the employment of heat in the treatment of many conditions from which they think they are suffering. In the great majority of these cases the patient takes it upon himself to prescribe Turkish baths or "bakings" because he has heard of some friend who has been benefited by some such plan of treatment, and we venture to assert that it is by no means a rare occurrence for a physician to be consulted by an individual whose unguided use of the Turkish bath has resulted in cardiac feebleness or vascular disorders, which are, of course, chiefly functional rather than organic. In certain patients, to whom at first glance the application of heat would prove advantageous, a more careful investigation reveals the fact that the heart is so dilated and feeble that such a plan of treatment would not only be harmful, but actually dangerous.

We have seen a number of cases of this kind within a comparatively short time, and they are particularly met with in persons past middle life, who attribute their sufferings to gout or other diathetic disorder, and in men and women who attempt to reduce their "flesh" by exposure to great heat and profuse sweats, with the result that they produce circulatory weakness. As a matter of fact the first class would be more benefited by carefully graduated exercises in the fresh air, in order that impure materials might be oxidized rather than formed and then excreted by sweating. In the second class there is a failure to recognize that the laying on of a certain amount of "flesh" is as natural with advancing years as is the change in the color of the hair or as is the development of wrinkles in the face. Indeed, in a large proportion of cases a gain of weight is indicative of health rather than disease, and he or she who attempts to meddle with nature's normal processes usually meets with disaster.¹

¹ Therapeutic Gazette, August 15, 1909.

THE RUSSIAN BATH (DIAPHORETIC)

In this the patient lies on a marble slab in a small room filled with steam. He is rubbed at intervals by an attendant to hasten perspiration. The temperature of the room is lower than in the hot rooms of the Turkish bath, the presence of steam rendering higher temperatures unbearable. The bather remains in this room from ten to twenty minutes. After this he takes a shower of cold water, 60° F. (15.6° C.), or a plunge in a pool at the same temperature.

Sweating baths on much the same principle were formerly practised by some of the tribes of American Indians as a method of treatment. "These baths were literally earthen ovens into which the patient crept and around which heated stones were placed to raise the temperature. When the patient had remained under preparation for a certain time he was taken out and immersed in cold water."¹

The Finns are accustomed to take steam baths prepared by pouring water on heated stones, after which they rush out, dripping with perspiration, and roll in the snow to produce a vigorous reaction. Currie refers to this practice of the Finns, and says that after rolling naked in the snow they return to their hot bath as before.

VAPOR OR SWEATING BATH

To apply this bath, place a blanket and mackintosh under the patient and wrap him in a blanket. Place a cradle over the patient and cover it with a mackintosh and blanket, tucking them in well around the neck and fastening them securely at the bottom so the steam cannot escape. Put an ice-cap or cold compress to the head. Let the steam come up gradually through a spout introduced at the foot of the bed and leading from a kettle of boiling water. Keep the patient in the bath for from

¹ See E. M. Rutteuber, *Memorial History of the City of New York*, p. 41; Benjamin Rush, *Natural History of Medicine Among the Indians*; Henry R. Schoolcraft, *The Indian Tribes of the U. S.*, Phila., 1851-55; Stoll, *Reisen in Guatimala*; Crevaux, *Travels from Cayenne to the Andes*; see also p. 33.

thirty minutes to one hour, or as required. Watch the pulse at the temples and the face, and take temperature, pulse, and respiration in the bath.



Fig. 94.—Vapor or sweating bath (Cohen).

A thermometer is to be placed in the bed, and the steam continued until the thermometer registers 120° F. (48.9° C.) or

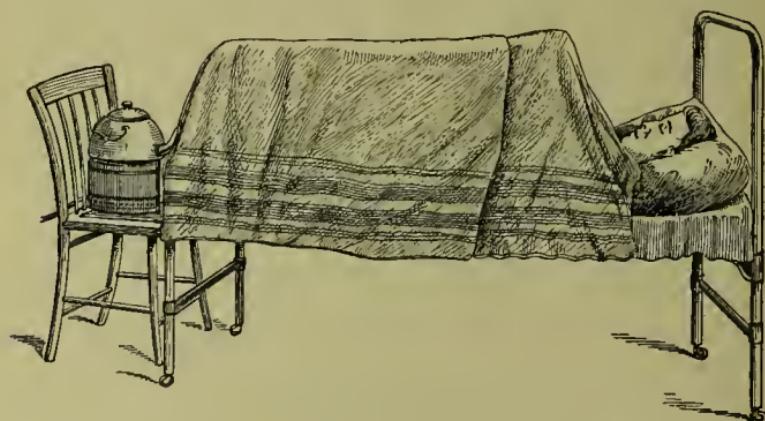


Fig. 95.—Simple arrangement for giving a hot-vapor bath (Stoney).

above, when the steam is stopped and the bather is treated as after the hot bath. As the water in the kettle boils down it must

be replaced by *boiling* water, not by hot or cold water, or the steam will stop until the water boils again. Careful watch must be kept over the bather's pulse, which can be taken at the temples.

In the absence of an oil-stove or a spirit-lamp, very hot bricks, smoothing-irons, or plates may be wrapped in wet flannel or cloths; the hot bricks in contact with the wet cloths will make steam. The cloths must be placed about the bather on



Fig. 96.—Hot-air cabinet bath: steam radiation.

plates or in dishes to prevent wetting the bed, and care be taken not to burn the bather. The bather may also be seated on a cane-bottom chair, the clothing being removed, and surrounded with blankets or comfortables, which must be fastened from the neck down (Fig. 96). A kettle of boiling water over a spirit-lamp or an oil-stove, or a pan or pail of boiling water, is placed under the chair. The feet may be put into a pail of hot water to increase the effect, because the blood-vessels of the surface of the body are dilated, and remain so while the heat or

vapor is continued; in this way the activity of the skin is increased, the pores of the skin are opened, and perspiration is produced. The attendant should be sure that the blankets or coverings are fastened closely around the neck and about

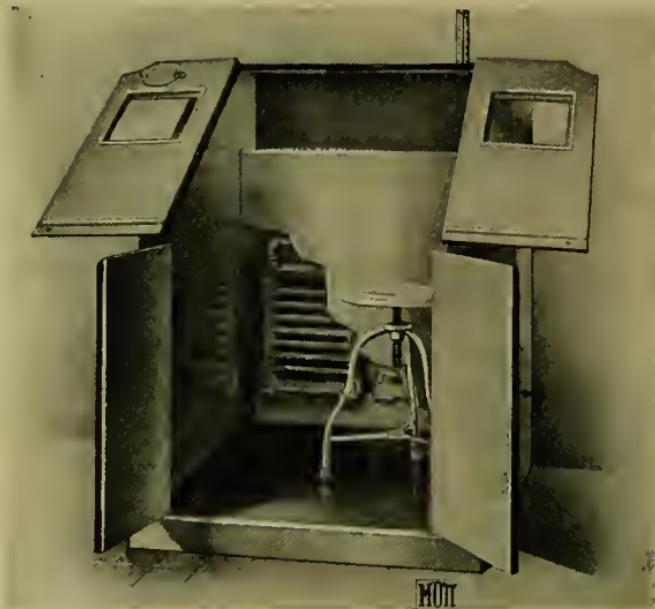


Fig. 97.—Hot-air or steam cabinet (J. L. Mott Iron Works).

the chair to prevent the steam escaping. The bather may generally be allowed to have plenty of water to drink.

THE ROMAN BATH

This bath is simply an application of massage with the use of unguents, either with or without the Turkish bath.

An **Irish-Roman bath** depends entirely on dry hot air and the consequent induction of free perspiration. There is usually a series of rooms heated to various degrees of temperature. The anteroom is at the ordinary temperature, *e. g.*, 66° to 68° F. (18.9°–20° C.), and the communicating rooms are at 95° to 104° F. (35°–40° C.). The next room is at 113° to 122° F. (45°–50° C.) and the fourth room at 149° to 194° F. (65°–90° C.). The bather is covered only with a bath-robe and wears sandals to

protect his feet from the hot floor. Sweating usually takes placee freely before reaehing the last room. This form of bath is deeidedly inferior to the use of the hot-air or eleetric-light cabinet.

Give plenty of water to drink.

THE HOT-AIR BATH AND THE ELECTRIC-LIGHT BATH

These are used as a preliminary treatment before applying douhes. The entire body, with the exceotion of the head, is enlosed in a cabinet provided with steam coils or eleetric lights.



Fig. 98.—Electric-light bath cabinet, open; seventy-two 16-candlepower lamps (Max J. Walter).

The head should have a cold turban and the body may be surrounded with a sheet or not, as desired. The heat in these eabinets rises to 140° to 180° F. (60° - 82.2° C.) and, as a rule, free perspiration is produced in seven to twelve minutes. If eleetric bulbs are used perspiration usually results in less time than with steam radiation, provided the heat is the same.

"The superiority of the hot-air cabinet over the ordinary Turkish bath is evident. The patient is surrounded by hot air in the cabinet and, the head being free, he breathes cooler air. Not only is he thus enabled to bear higher temperatures, but he is free from dyspnea, which is so distressing to many in the hot-air chamber of the Turkish bath, and which is doubtless due to a defective supply of oxygen; the latter, being expanded by heat, is not breathed in sufficient quantity to fulfil its physi-

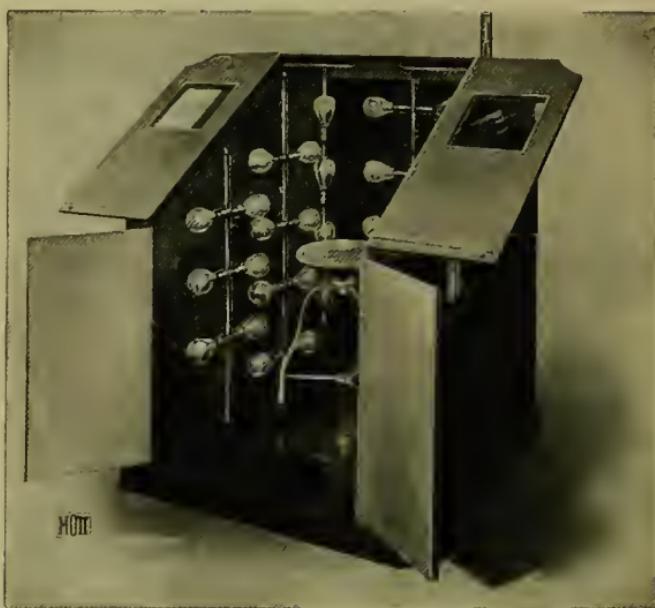


Fig. 99.—Electric-light cabinet (J. L. Mott Iron Works).

ologic function. If oxidation be the chief object of the hot-air bath, the cabinet bath must be far superior to the Turkish bath, because it permits a more abundant supply of oxygen as regards the temperature, and thus facilitates oxidation. Besides, the patient is not subjected to the admixture of emanations from the large number of persons who often occupy the hot-air chamber simultaneously in the Turkish bath establishments."¹

Advantages of the Electric-light Cabinet Over that Heated

¹ Baruch, Hydrotherapy.

by Steam Coils.—The electric-light cabinet is safer, quicker in action, and probably has a greater and more beneficial effect on the underlying tissues. The author has known an instance in which the steam coil burst, and if anyone had been in the cabinet at the time serious injury would have resulted. We would never have believed such an accident possible unless from personal observation. The steam was turned on under high pressure into a coil which was not known to be defective, but was supplied by a well-known manufacturer.

It is common observation, but not always true, that perspiration ensues in an electric-light cabinet more quickly than in the hot-air cabinet.

The well-known penetrating quality of the electric-light rays probably aids metabolic processes in the deeper structures. Dr. Peck states this proposition as follows:

"These conclusions seem to be well founded when one stops to consider the physical properties of the two agents. In one case the body is heated by a process of convection, successive layers of tissue being heated until the body temperature is raised 1 or 2 degrees; while, on the other hand, the light and heat rays, which are closely related in physical properties to sunlight rays, penetrate directly the tissues and produce their effects upon the metabolic processes by directly stimulating the normal body activities. We are coming more and more to believe that these metabolic processes are carried on through the intervention of certain enzymes or ferments, and exposing the body to the electric-light rays apparently stimulates these fermentative processes to more normal activity."¹

The same conclusions would be true of cabinets fitted with incandescent or electric arc lights.

It is interesting, historically, to note that Aretæus was the first to recommend that the head should be excluded in giving vapor baths; and it was he who advised sulphur baths for the cure of melancholy and leprosy.

¹ Yale Medical Journal, May, 1909.

FOOT-BATH

The hot foot-bath is the best and most important of the local baths. It is a popular method of treating a cold in its earliest stage and is a valuable preventive measure.



Fig. 100.—The leg-bath
(Luke).

Hot water and a small tub or pail and an additional supply of very hot water to reinforce the heat of the bath are the only means required; although it may be desirable in some cases to add a little mustard so as to invite the flow of blood to the feet and ankles. The temperature of the water may be gradually raised to 110°, 115°, or 120° F. (43.3°, 46.1°, or 48.9° C.) and the duration may be from ten to fifteen minutes. The depth of the water may be 8 or 10 inches. It is a proper procedure after the initial chill of pneumonia. In this case mustard should be added to the bath, which should be given in bed (see p. 106). Sprains of the ankle or foot, bruises, cramps in the legs, etc., are not only rendered much less painful by a hot local bath, but the way is prepared for massage and permanent dressings.

MEDICATED OR MODIFIED BATHS

Sulphur baths may be prepared at home according to the following formula, which is sufficient for a bath of 30 gallons:

Precipitated sulphur.....	2 ounces.
Sodium hyposulphite.....	1 ounce.
Dilute sulphuric acid.....	$\frac{1}{2}$ "
Water.....	1 pint.

The above ingredients should be mixed together and then added to the bath.

Warm Mustard Bath.—A modification of this bath has re-

cently been recommended by O. Heubner,¹ who has used it with great success in the capillary bronchitis of young children and in the suffocative attacks which are marked in weak rachitic children. About 3 pints of warm water are placed in an open vessel and 1 pound of mustard meal is added and stirred until the thin mixture emits the irritating fumes which cause smarting of the eyes. Then a linen cloth, of sufficient length to cover the child, is saturated with the mixture and wrapped about the child, who is then covered with a woolen blanket reaching to the neck. After ten or fifteen minutes the child will complain of discomfort, and as the wrappings are removed the skin shows marked reddening. The child is then washed in warm water and placed in an ordinary warm wet pack and allowed to remain for one or two hours. This produces diaphoresis. After the pack the child is put in a warm bath which is gradually cooled. He is dried and allowed to remain quiet the remainder of the day.

One advantage of this method is that the irritating fumes of the mustard are not inhaled and that the reaction is more perfect.

A simple form of mustard bath is composed of potassium sulphid 1 ounce to 7 gallons of hot water.

An alkaline bath may be made by adding 1 ounce of sodium bicarbonate to every 5 gallons of water.

Pine-needle Bath.—This may be used with the vapor cabinet. An ounce of pine-needle oil (*oleum pini sylvestris*) is placed in the vapor pan with 3 ounces of water. The patient is then steamed for twenty or thirty minutes in the cabinet; during this time perspiration is profuse. Afterward massage may be given. Baths may be medicated with pine-needle extract, 2 ounces to 40 gallons.²

¹ Therapie der Gegenwart, January, 1905.

² Langbein's coniferol tablets may be obtained of the Hygienic Resorts Bureau, Chancery Lane, W. London. See also under Dr. Zucker's Carbonated Bath, p. 313.

"NAUHEIM" BATHS; CARBONATED BATHS; ACID BATHS (KISCH); EFFERVESCENT BATHS

The Nauheim bath depends on the presence of carbon dioxide with other chemicals, principally sodium chlorid and calcium chlorid, in various degrees of solution. The natural baths are given *par excellence* at Bad Nauheim in the Grand Duchy of Hesse, near Frankfort, in Germany, near the southern foot of the Taunus Mountains. (See pages 134 and 221.) The growing popularity of Nauheim is shown by the presence of 30,000 visitors in 1907,¹ but the greatest tribute to their efficacy is a widespread effort to prepare these baths artificially and avoid the long journey to Nauheim. The class of cases for which the treatment is sought renders it all the more desirable that the forms of treatment practised at Nauheim be provided, if possible, at home.

The season at Nauheim is from May 15 to October 1. During hot weather patients can, as a rule, take a bath at a lower temperature than when it is cold; they can also take an effervescent bath at a lower temperature than a bath in still water, the presence of carbonic acid gas counteracting the feeling of cold, yet not interfering with the circulatory reaction as in the case of still water at a corresponding temperature. Dr. Thorne usually lets the patient have a hot-water bottle in bed after the bath unless the weather should be very warm. If, however, the patient still does not remain comfortably warm, he regards it as an indication for raising the temperature of the bath. It is noted that a bath which would produce coldness and cyanosis of the extremities at the commencement of the course is usually productive of a sense of warmth and comfort, and a marked improvement of color toward the end of the treatment; this is evidence of improved reaction and circulation.

If patients have rigors, the baths are too long or too strong or perhaps they should be suspended. These rigors may occur even when the extremities are warm and of good color.

¹ In 1907 419,277 baths were given. In 1909 about 35,000 visitors were recorded.

If they occur at the outset, they will probably decrease as successive baths are given, and are not always a serious indication.

Aside from the associated forms of treatment, such as resisted (Schott) movements, graded walks, diet regulations, and the benefits of climate, the baths are given at Nauheim according to a gradual increase in strength as regards solid and gaseous contents; this is a distinguishing feature. The temperature of the three springs used at Nauheim are 85° F. (29.4° C.), 90° F. (32.2° C.), and 95° F. (35° C.). The duration of the baths is short, four to ten minutes as a rule. The three types of baths are as follows:¹

The **first** and mildest type, the so-called *thermal baths*, are obtained by admitting the water to large reservoirs, where in contact with the atmosphere the CO₂ escapes and the calcium and iron salts precipitate. These salts color the water yellowish brown.

The **second type**, containing a little more CO₂, is the *thermal sprudel bath*, and is obtained by conducting water to subterranean air-tight tanks, from which it is conveyed to bathing tubs. This water is clear or slightly yellow, having lost but a proportion of its CO₂.

The **third grade**, or effervescent type, is known as the *sprudel baths*, and contain the full amount of CO₂. In their natural state the waters contain from 550 to 1300 cc. of CO₂ to the liter, but, of course, much of this instantly escapes as soon as the water reaches the tub. These baths are strongly effervescent, bright, sparkling, and clear as crystal.

Clear **brine baths**, containing 3 per cent. of chlorids and no gas, are also used.

ARTIFICIAL NAUHEIM BATHS

These are quite extensively used and some advantages are claimed by those who have taken the trouble to apply them in selected cases according to a definite scheme of graduation. In

¹ See description by Paul C. Franze, M. D., in an address before the Hunterian Society of London, March 23, 1904. Also article on Bad Nauheim, by J. H. Honan, M. D., Illinois Medical Jour., April, 1910.

America, Dr. Thomas E. Satterthwaite and Dr. C. N. B. Camac, of New York,¹ and Dr. J. M. Anders, Dr. S. Solis Cohen, and Dr. James Tyson, of Philadelphia,² and Dr. Philip K. Brown, of San Francisco,³ have endeavored to place this form of treatment on a definite and effective basis. The necessary salts can be obtained in the most convenient form from several manufacturers and the use of cakes of acid sodium sulphate as furnished by them is far preferable to the hydrochloric acid which was previously used for the acid element in the bath. The latter is liable to destroy the tubs and injure the patient. It furthermore yields a very uneven effervescence and is hard to regulate.⁴ The box of the Cassebeer Co. contains 8 disks of acid sodium sulphate each of $1\frac{3}{4}$ lbs., wrapped in heavy lead foil, and four 2-lb. packages of sodium bicarbonate. The method of preparing the bath is as follows:

Fill a porcelain or enameled tub with 50 gallons of water at 105° F. (40.6° C.). The required amount of bathing salt is then added. This, in an ordinary Nauheim bath, should consist of from 2 to $3\frac{1}{2}$ per cent. of a mixture of sodium chlorid and calcium chlorid. In the stronger baths the imported concentrated salts, the *Mutterlauge* of Nauheim, is added to this mixture. It contains about 75 per cent. of calcium chlorid and may be added to the bath at about the middle of the course. This *Mutterlauge* is not a natural ingredient of any of the springs except-

¹ International Clinics, vol. i, Thirteenth Series, 1903.

² Trans. Philadelphia County Medical Society, January 31, 1905.

³ California State Journal of Medicine, April 1, 1907.

⁴ Standard packages containing cakes of acid sodium sulphate and packages of sodium bicarbonate are supplied by the Shepard Pharmacal Co., 275 Water Street, New York, and Schieffelin & Co., New York. If the prepared salts are not accessible, the elements may be prepared as follows: Take sodium carbonate, $1\frac{1}{2}$ lbs.; sodium bicarbonate, $\frac{1}{2}$ lb.; calcium chlorid, 3 lbs.; sodium chlorid, 2 lbs. Mix and dissolve in the bath and add slowly the sodium bisulphate, 1 lb., which should be kept by itself. This gives a bath of moderate strength. In order to avoid the objectionable features of acid sodic sulphate use is made of a solution of formic acid. "Dr. Zucker's carbonated bath" and the "ZeO₂ bath" depend on the action of formic acid on sodium bicarbonate (see p. 314). The author prefers "Dr. Zucker's bath" to any of the others. This bath cannot corrode tubs or fixtures.

ing to a very small extent, but is a by-product of neighboring chemical works and is used at Nauheim to stimulate the skin and increase and prolong the effect of the carbonic acid gas effervescence. The attendants and the patients themselves duly value this addition to the bath. It is quite extensively exported from Nauheim for use where artificial Nauheim baths are given.

The artificial package is generally faulty in wholly omitting both calcium chlorid and sodium chlorid, although the latter can easily be obtained. The reason they are omitted is on account of the additional weight of the common salt and the additional cost of calcium chlorid and magnesium chlorid. The calcium chlorid is difficult to handle in a solid form on account of its irritating qualities and its strong affinity for water. The acid sodium sulphate likewise must be kept in a very dry place, otherwise it is sure to crumble, the free sulphuric acid eating its way through the container, ruining the soda or other neighboring objects. Naturally the efficiency of the bath cannot be insured with deteriorated contents.

Precautions.—The Triton Co. offers the following precautions as to the *bath-tub*: In order to prevent any injury to the bath-tub by contact with the acid cakes there are three methods of procedure: First, allow each cake to rest on the lead foil provided in the boxes; second, use three or four ordinary saucers and place the cakes on them; third, use a piece of rubber sheeting sufficient to cover the bottom of the bath-tub and put the cakes on the sheeting. The use of the rubber sheeting is advised as the most efficient and reliable method of protection.

Always allow the cakes to dissolve entirely before drawing off the water from the tub. The water is alkaline and will not injure the drain-pipes.

Dr. Zucker's Carbonated Bath.—Under this name packages have been prepared by Max Elb, of Dresden, Germany, and introduced into the United States and England. This process of preparing artificial carbonic acid baths depends on the use of formic acid in solution and bicarbonate of soda enclosed in

gauze bags. A sufficient quantity of 80 per cent. commercial formic acid in a pint bottle is poured into a bath of 40 gallons of water at 95° F. (35° C.). The patient enters the bath and during the first half of the allotted time gently applies the bags or cushions containing the sodium bicarbonate to the trunk and limbs. Carbonic acid gas is immediately generated in the neighborhood of the alkali and soon permeates the entire bath. During the latter half of the bath, which is intended to occupy in its entire duration from fifteen to thirty minutes, the subject should rest quietly and allow the entire body below the neck to be subject to the action of the contained gas. To render this package complete, 3 or 4 pounds of common salt and 3 or 4 ounces of calcium chlorid should be added. The formic acid supplied was analyzed by the author and found to be of specific gravity 1.18 and free from hydrochloric acid.

These baths are furnished in five forms: The single carbonic acid bath; the carbonic acid chalybeate bath; carbonic acid bath with pine-needle extract; chalybeate with pine-needle extract; with various aromatic herbs, essences, and extracts, such as lavender, chamomile, thyme, sage, etc.; 15 minims of an ethereal oil or from 2 to 4 ounces of an alcoholic extract are sufficient for a bath.¹

The author tested this bath, and found no unpleasant effects

¹ Descriptions of these baths and their physiologic action may be found in the following references: Deutsche medicinische Wochenschrift, No. 3, 1905, p. 107; Münchner medicinische Wochenschrift, No. 5, 1905, p. 236; Medicinische Klinik, Heft 9, 1905, p. 273; Pharmaceutische Centralhalle, vol. v, January, 1905, p. 5; Pharmaceutische Zeitung, vol xi, January, 1905, p. 30; Neueste Erfindungen und Erfahrungen, part 3, Heft, 1905, p. 127; Süddeutsche Apotheker-Zeitung, vol xvii, February, 1905, p. 112; Pharmaceutische Zeitung, vol. xxv, February, 1905, p. 167; Die medicinische Woche, No. 11, vol. xiii, March, 1905, p. 87; Medico, No. 4, 1905, p. 62; Zeitschrift für Krankenpflege, February, 1905, p. 72; Zeitschrift für Krankenpflege, October, 1906, p. 397; Deutsche Aerzte-Zeitung, No. 23, vol. 1, December, 1907; Russische Medicinische Rundschau, No. 5, 1907; Therapeutische Rundschau, No. 3, January, 1908; Herman C. Riggs, Medical Times, April, 1910.

In the United States the packages may be obtained of George B. Evans, Philadelphia, and The Smith, Kline and French Co., 429 Arch Street, Philadelphia.

on the skin and no injury to a porcelain tub. An agreeable stimulation and slight reddening of the skin was noted.

In Great Britain packages known as *Sandow's* and the *Croyden* are used. The former contain 4 packets of sodium bicarbonate and 8 tablets of acid sodium sulphate. They are prepared so that 8 parts of the sodium bicarbonate exactly



Fig. 101.—The Fischer-Kiefer CO_2 generator for Nauheim bath (Luke).

neutralize 12 parts of the acid sodium sulphate. The alkali should be a little in excess.

Apparatus for generating carbonic acid gas and mixing it with the water have been devised; one of the best is probably that known as the Fischer-Kiefer Company's generator and is made in Zurich (Fig. 101). Similar apparatus is made by the Electritats gesellschaft Sanitas, Friedrich Strasse, 131 d.; Berlin,

N. (Fig. 102). Another is made by the Kny-Scheerer Co., of New York (Fig. 103).

If sea-water be accessible, it may be used for the artificial Nauheim bath. Besides the chlorids, sea-water contains bromids, both of which add to the efficacy of the bath. At the Hotel Chamberlin, at Fortress Monroe, Virginia, sea-water is thus

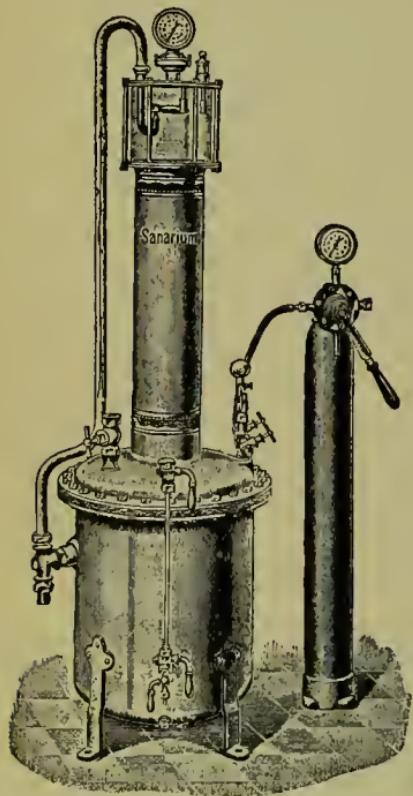


Fig. 102.—Carbonic acid apparatus.

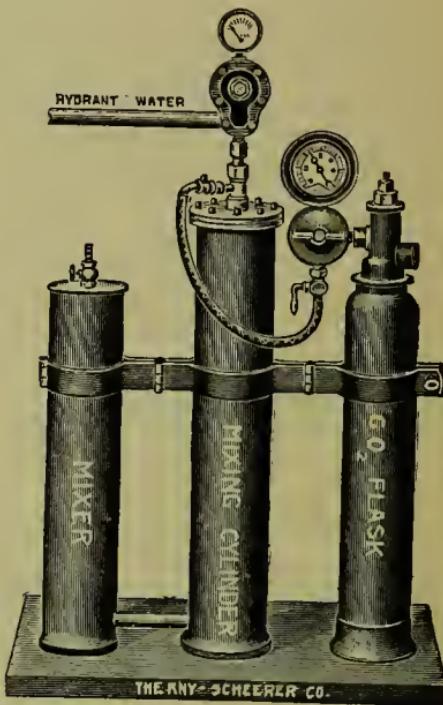


Fig. 103.—Carbonic acid gas mixing device for Nauheim baths.

utilized and the carbonic acid gas under pressure is thoroughly mixed with the water by means of an electrically driven apparatus.

Satterthwaite Method of Giving Nauheim Baths.—Dr. Satterthwaite has formulated an excellent scheme for the six weeks' course of 35 graduated baths which will prove useful in practice:

First week (No. 1 bath), $\frac{1}{2}$ per cent. plain warm salt bath (2 pounds of bathing salt to 50 gallons of warm water). Temperature 98° F. (36.7° C.). Duration four minutes. Intermission on the third and sixth days of this week.

Second week (No. 2 bath), $\frac{3}{4}$ per cent. warm salt bath (3 pounds of bathing salt to 50 gallons). Carbonic acid gas $\frac{1}{2}$ per cent. (2 disks acid sodium sulphate to 1 package, 2 pounds sodium bicarbonate). Temperature 97° F. (36.1° C.). Duration six minutes. Intermission on the fourth day of this week.

Third week (No. 3 bath), 1 per cent. warm salt bath (4 pounds of bathing salt to 50 gallons). Temperature 96° F. (35.6° C.). Carbonic acid gas $\frac{1}{2}$ per cent. (4 disks in 2 packages). Duration eight minutes. Intermission on the fourth day.

Fourth week (No. 4 bath), $1\frac{1}{2}$ per cent. warm salt bath (5 pounds bathing salt to 50 gallons). Nauheim concentrated brine salt (Mütterlauge salts), 8 ounces, or $\frac{1}{2}$ pint of the liquid salts, CO₂ $\frac{3}{4}$ per cent. (6 discs to 3 packages). Temperature 95° F. (35° C.). Duration ten minutes. Intermission on the fourth day.

Fifth week (No. 5 bath), $1\frac{1}{2}$ per cent. warm salt bath (7 pounds bathing salt to 50 gallons). Mütterlauge salts, $\frac{3}{4}$ pint; CO₂, $\frac{3}{4}$ per cent. (6 disks to 3 packages). Temperature 94° F. (34.4° C.). Duration twelve minutes. Intermission on the fifth day.

Sixth week (No. 6 bath), 2 per cent. warm salt bath (10 pounds of bathing salt to 50 gallons). Mütterlauge, 1 pint; CO₂ 1 per cent. (8 disks to 4 packages). Temperature 93° F. (33.9° C.). Duration fourteen minutes. Intermission on the fifth day.

In the case of robust people we may commence with No. 2 bath, or in the case of a delicate person it may be best not to exceed the strength of No. 4 bath.

In preparing the bath the best way is to draw about 20 gallons of hot water in the tub. A tub 5 feet long will then be filled to a depth of 6 inches. The sodium chlorid is then dis-

solved and well distributed, and if the Mütterlauge is to be used it is thoroughly diffused through the bath. If cakes of acid sulphate are to be used they are now broken with a hammer and laid on the accompanying lead foil, and the bicarbonate is laid on top, 2 disks to 1 package. The water is now drawn in the bath so that the 50 gallons shall have a temperature as designated, 98° F. (36.7° C.) for No. 1 bath, or 93° F. (33.9° C.) for No. 6 bath. The alkaline and acid salts are then lowered on their leaden foils at places along the bottom of the tub. Effervescence begins at once and may take eight or ten minutes for completion. It is best to start with water a little above the requisite temperature to allow for cooling, and the lead and any undissolved sulphate should be removed before the patient enters. If formic acid is used, as described on pages 313 and 314, the preparation of the bath is simpler.

Massage may be employed in the bath, after which the patient is carefully dried with warm towels and put to bed, or the patient should rest at least for an hour.

The **effect of the baths** at Nauheim and of the artificial baths is principally on the heart and blood-vessels. The resistance movements which have been systematized by Professor Theodore Schott and his brother, the late Dr. August Schott, are considered by many an essential feature of the treatment and are most thoroughly carried out at Nauheim, supplemented by the *terrain kur*, or graduated walks on the hillside (Oertel System).

The immediate effect of the first bath is a diminished pulse-rate, intensified heart sounds, and in a case of extreme cardiac dilatation, probably a reduction of the size of the heart and its cavities. This has been noted by competent observers after a single bath. While this is not always maintained, each succeeding bath leaves the organ a little smaller than in the previous one, and thus compensation is finally restored, in most cases at least.

The *effect of carbonated baths* on an intermittent heart, with palpitation following severe diphtheria and augmented by tobacco, constitutes the subject of an interesting personal ob-

servation by Dr. Philip King Brown. At the time the baths were begun the patient was thirty-six years of age and tobacco had not been used for a month. The heart, nevertheless, was omitting every third or fourth beat and the rate was between 90 and 100. The blood-pressure was 120 with Stanton's sphygmomanometer. Two courses of Nauheim baths were given, with 20 in each series, and a ten days' intermission between them. In the first series resisted movements followed the baths for twenty minutes. In the second series they preceded the baths. After the first five baths the heart would frequently beat fifty or sixty times without any intermission. The rate for some hours after treatment fell 15 to 20 beats, reaching normal at the end of the fifth bath. From that time on the pulse varied from 72 to 80, being brought down sometimes to 68 after treatment. The second series of baths was carried out to study the effect of movements given before the baths.

In this particular instance it was shown that resisted movements had the same effect as the bath, but on evenings when they were not followed by the bath the effect was not as lasting by several hours. It was noted that exhaustion after work which preceded the first baths and which began to show itself after the first series, was definitely relieved after the second series.

Dr. Brown has also studied in his own person the effect of the various elements of the Nauheim bath and has furnished the mean of the observations made during two years. A fifteen-minute warm bath, 94° to 98° F. (34.4°–36.7° C.), lowered the pressure on an average of 15 mm.; pulse-rate varies little or nothing.

A fifteen-minute strong NaCl bath, 7 pounds to 40 gallons, 94° to 98° F. (34.4°–36.7° C.), lowered the pressure 10 to 15 mm.; the pulse may be slightly slowed.

A fifteen-minute calcium-chlorid bath, 1½ pounds to 40 gallons, 94° F. (34.4° C.) temperature, raised the pressure 15 mm. This is true even if the pressure has been raised already by food taken a short interval before.

A fifteen-minute mustard bath, 1½ pounds to 40 gallons,

94° F. (34.4° C.), had the same effect as a warm bath, lowering the pressure 15 mm., without altering the pulse. The skin was scarcely reddened.

Three pounds of mustard in a bath of 94° F. (34.4° C.) temperature, given for ten minutes, or the weaker mustard bath, with vigorous friction applied to the skin, has the effect of raising the pressure, and reddening the skin markedly for an hour or more. A fifteen-minute full strength, alkaline effervescent Nauheim bath at 86° to 94° F. (30°–34.4° C.), raised the pressure rapidly during the first half of the bath, and more slowly during the last half, making it altogether about 20 mm. *This effect lasts during the daytime about four hours.* When the bath is taken at night, 11 P. M., the pressure on the following morning at 7 A. M. is not as low as normal by 5 to 10 mm., showing that the usual drop through the sleeping hours is not as marked as is normal.

Dr. Brown records several cases of fatty infiltration of the heart with obesity successfully treated by Nauheim baths and the von Noorden anti-obesity diet.

Regime at Nauheim.—At Nauheim the patient is usually up at 6.30 or 7 A. M. and as soon as dressed starts for the springs to drink the water. After about an hour he returns for breakfast, rests an hour or more, and then goes out again for his bath. He returns to his hotel and rests for another hour in bed or until nearly lunch time. In the afternoon he drives or takes other outdoor exercise, according to the advice of his physician, but the rest in bed forms a large part of the usual routine of treatment.¹ (See p. 133.)

The Effect of Hot and Cold Baths on the Size of the Heart.—Since Moritz² introduced the method of measuring the dimensions of the heart by means of the *orthodiograph* comparative measurements are for the first time possible, and, in competent

¹ In London artificial Nauheim baths are provided at The St. George's Nauheim Institute, 6 George Street, Hanover Square, W.; in Boston and Philadelphia, at the Medical Baths; and at various Medical Baths or Hydriatic Institutes in Boston, New York, Philadelphia, Chicago, and other cities.

² Münchener Med. Woch., 1900, No. 29.

hands, it would seem to be a fairly precise instrument.¹ The original model has been greatly improved by Hoffmann, Levy-Dorn, and Groedel.² There are very few of these instruments in the United States. The x -ray tube and the sheet of paper for marking the cardiac boundaries are attached to movable arms acting at exactly the same relative distance on opposite sides of the patient and moving harmoniously. By an ingenious



Fig. 104.—Orthodiograph.

contrivance the heart's area can be traced by means of an attached fluoroscope and the record made automatically on the paper for future comparison. This is infinitely superior to the previous method of percussion or auscultatory percussion and is the basis of conclusion which Moritz, August Hoffman, Rudolf

¹ Manufactured by Reiniger, Gebbert and Schall, at Erlangen, Germany, and also by Electricitatsgesellschaft "Sanitas," Berlin, No. 24, Friedrichstrasse, 131 d. Price about \$156.00 to \$125.00.

² Franz M. Groedel, Orthoröntgenographie, Munich, 1908. Also "Die Orthodiographie," Dr. Karl Francke, Munich, 1910.

and Beck,¹ and the Groedels of Nauheim have drawn as to the effect of baths on the heart.

In ordinary radiographs the shadow of the heart or of any internal organ is necessarily larger than its natural size as the rays from the anticathode of the Crookes tube are projected from a point in the shape of a cone; but with the orthodiograph the source of the Röntgen rays, the center of the fluorescent screen, and the pneumatic pen are kept always in line. The arms supporting these parts of the instrument are attached to a carriage which, while allowing all motions in one fixed plane, will keep this straight line perpendicular to the plane. Thus the pencil of rays coming from the tube, through a small aperture in a lead diaphragm to the center of the screen, while it may be moved over a considerable surface, will always occupy parallel positions.²

Rudolf and Beck reported that in all the patients they studied, the size of the heart was measured immediately before the baths, and the operation was repeated as soon after the bath as circumstances permitted, the time between the end of the bath and the estimation of the changes in the heart not exceeding two or three minutes. The results obtained were quite uniform. The effect of the hot bath was to diminish the size of the heart, the amount of the change being quite considerable in most cases. In one case the heart remained unchanged in size. The effect of the cold bath was to increase the size of the heart, no change being noticed in one case only. The diminution in the size of the heart after hot baths was accompanied by an increase in the rapidity of the pulse and in the supply of blood to the skin, phenomena which are, of course, commonly observed after hot bathing. Cold baths, on the other hand, were followed by increased pallor of the skin and diminution in the frequency of the pulse. The limited number of cases examined does not

¹ Münchener Med. Woch., January 26, 1909.

² See Orthodiography in the Study of the Heart and Great Vessels, by Thomas A. Claytor and Walter H. Merrill, Trans. Association of American Physicians, 1909. Studies made at the Garfield Memorial Hospital, Washington, D. C.

allow final conclusions to be drawn, but the uniformity of the results obtained speaks for the correctness of the findings: Whether the therapeutic indications for the use of cold and warm baths will be modified by the discovery of these changes in the dimensions of the heart with the different temperatures of the water remains to be seen.

Rudolf and Beck measured the heart immediately before entering the bath and again directly afterward. It was uniformly found that after a hot bath the size of the heart was considerably diminished, and, with this, a marked increase in the pulse rate; after a cold bath the size of the heart increased, the skin became pale, and there was a diminished pulse rate. Rudolf and Beck found that, in the case of Nauheim baths, natural or artificial, even in water with a temperature of 87° to 95° F. (30.6°–35° C.), orthodiagrams show a marked diminution in the size of the heart. Within this temperature range, then, it would appear that the heart responds as in the case of hot baths. This would confirm the statement of Leslie Thorne, that in many cases a good reaction cannot be obtained if the temperature of the bath be below 96° F. (35.6° C.). If this be found to be the case in any given instance, it would be unwise to give the baths at any lower temperature. (See pp. 140–146.)

THE OXYGEN BATH

This bath depends on the chemical generation and diffusion of oxygen gas in water. It is one of the newest features of hydrotherapy, having been introduced only as late as 1904 by Sarason. He used hydrogen peroxid at first and then devised the method of first dissolving about 300 gm. of sodium perborate in the tub, adding then 15 gm. of manganese borate. This latter acts the part of a catalyzer and causes the sodium perborate to part with oxygen. Various modifications of the oxygen bath have been placed on the market in Germany. Sarason adopted the name "Ozet bath"; Wolfstein called his "Brozon"; Kopp and Joseph gave theirs the name "Zeozon." Sarason's bath has been introduced to the American market as the "Perogen bath," the exact nature of its constituents are not yet made public, as

patents are pending. The proprietors, Morgenstern and Co., of New York, state that they will publish the nature of the catalyster when a patent is issued. The "Ozet" bath is patented in all European countries. These baths are, in a measure, analogous to carbonic acid baths, in that minute bubbles of gas are generated and attach themselves to the bather's skin, producing a sense of exhilaration which is succeeded by a sedative action rendering it of considerable therapeutic value. The only description of the bath that we have met with in English is by Dr. Fredrich Grosse,¹ but several papers have been published recently in Germany. Among these are papers by Frankl, Tornai, and Sommer.

Dr. Grosse's description of the oxygen bath is as follows: "The two salts are sold in the market in separate bags, packed in tins, and keep well for any length of time. The label gives the necessary details as to the technic of the procedure, which yields about 35 pints of nascent oxygen. The oxygen bath is usually given as a full bath (reaching up to the jugular fossa), but other forms, such as hip-baths, are also recommended. The patient lies therein without any unnecessary movement, and friction or soaping is to be avoided. As a rule, plain water is used, but there is no objection to the addition of other ingredients.

The temperature of the water is usually, according to the writers, 93° to 89.5° F. (33.8°–31.9° C.); some of them administer it as warm as 98° F. (36.6° C.); Laqueur¹ considers lower degrees objectionable, as he thinks patients would feel chilly, the oxygen not being so powerful in warranting the sensation of warmth as the carbonic acid. I find, however, at least in some cases, that the baths also of 88° to 86° F. (31.1°–30° C.), temperatures which are mentioned also by Winternitz, are tolerated with the same good effects.

"The duration of the bath is, as the first observers state, fifteen to twenty mintues; however, I see no contraindication to prolong it, in appropriate cases, up to thirty minutes. Even

¹ The Post-Graduate, September, 1909.

then enough oxygen is left to cover the bather's skin, especially if, by stirring up the lower strata of the water, the last traces of the chemicals are pushed into action.

"The number of baths given as regular treatment of chronic cases should be, according to Tornai,² from fifteen to twenty, and according to Sommer,³ from twenty to thirty. The literature on the subject is yet, of course, scanty, but all writers advise taking one bath either on each of five consecutive days, with four or five free days, or every second day. In hydrotherapeutic practice waterless days are frequently introduced during the course of a 'cure.' In short, I hold it advisable not to give routine prescriptions, but rather to be guided by the needs of the case. Again, as to the hour of bathing, it is best to take into consideration all the numerous trifles of the sufferer and his surroundings, with the only exception that, to bring on sleep, the bath should be taken from thirty minutes to one hour before retiring, and even here we have to consider that sometimes we meet a case who experiences, even after the most sedative application, a transient period of excitation before sleep occurs.

"As the oxygen bath is, altogether, a rather calmative, rest-producing, and yet indirectly stimulating—the German expression 'schönend' includes not only these adjectives but also our epithet *protective*—application, it is self-evident that before the bath the patient should not have gone through any exciting movements of any nature, such as walking, for instance; and after it also he should rest one or two hours. It may also be useful to mention that he ought to be uniformly warm; under no circumstances should he enter the tub with cold feet, because the procedure is by no means one accumulative of heat.

"As the temperature of the oxygen bath is usually a few degrees lower than that of the skin, the bather may, at the first impact of the water, or even as long as one minute, realize a chilly feeling; but after a minute or so this is changed into an agreeable sensation of warmth, 'as if the water had, all of a sudden, become warmer.' This feeling stays as long as the bath lasts, so that the patients often remark 'they wished they

could remain in it for hours' (Tournai). As soon as the bather lies quiet, his skin is quickly covered by a glistening layer of finest oxygen bubbles, which become closer every minute. Forming, driving up, bumping against the skin and its lanugo, they cause a queer tickling and prickling sensation that is very agreeable. A discoloration is caused by the formation of manganese oxid from the catalyser and consists of a very fine, soft, slimy mud that covers bather and tub; though it is very easily rinsed away by water without leaving any lasting stain whatever, it is by no means recommendatory of the ozet bath. In contradistinction, the perogen bath leaves merely a very fine yellowish hue scarcely visible on a wet towel.

"According to modern osmology, the skin is always covered with a layer of air, the molecules of which adhere relatively closely to the body surface, so that one might roughly speak of an involucrum or tegument of condensed air. This resists decidedly even mechanical removal, so that Zickel,⁴ a pioneer osmologist, advocates, in order to facilitate and increase the effect of tub baths, rubbing of the skin with alcohol and application of thorough wet and dry friction before such a hydrotherapeutic procedure is undertaken. As to the oxygen bath, the procedure may be thus: after the perborate has been added, the patient, having previously been rubbed with alcohol, enters the tub and undergoes gentle but thorough friction all over, under water. Then the catalyser is added.

"In the oxygen bath the layer of oxygen is substituted for the air involucrum and so increased that it becomes, as it were, visible. The point of indifference of water is 93° to 99° F. (33.8°–37.2° C.). This is much higher than that of air, *i. e.*, 68° to 77° F. (20°–25° C.), and the indifference point of O₂ is decidedly lower yet. Furthermore, as gas is a bad conductor of warmth, the terminals of the thermic nerves are surrounded by a medium perceptibly warmer than the water. All this combines to bring about a sensation of warmth that is conveyed to the central stations, and the bather feels the water warmer than it really is. Besides this action on the thermic nerves,

other stimuli act upon the nervous elements within the skin, regulating the peripheral circulation. Whether these are of physical or of chemical nature, or both, is difficult to decide, but there is no doubt that a pronounced contraction of the cutaneous vessels takes place, causing a distinct paleness. Entirely otherwise than in the carbon-dioxid bath and other water applications, this vessel contraction and consequent peripheral anemia is not accompanied by chills or goose-skin. Perhaps the central nervous stations, because of the aforesaid impression, fail to institute the contraction of the cutaneous muscular elements; perhaps, also, we have there a specific stimulus for the skin heart of Hutchinson.

"As to the pulse, the rate is, as all observers report, reduced in proportion to what it was before the bath, and at the same time irregularity and weakness are markedly corrected; indeed, in this line the oxygen bath has the very same favorable influence as the carbon-dioxid tubs. The respiration is acted upon in a similarly sedative way; the inner temperature remains unchanged. The experimenters do not fully agree as to blood-pressure. We know that baths below the indifference point are liable to increase it; those of an indifferent temperature to leave it unchanged, and baths warmer than this lower the pressure. Temperature seems to have more effect upon it than any other factor. According to this the figures of Ekgren,⁵ Winternitz,⁶ Laqueur, Schnuetgen,⁷ Tornai, Mueller,⁸ and Scholz⁹ point mostly to a reduction; only Ekgren observed an increase after 91° F. (32.7° C.). Altogether, the tabulated figures are mostly relatively small, in normal cases hardly over or under naught. Immediately after the beginning of the bath a transient increase may be noticed, and, again, well observed cases show lowered figures even for hours afterward. Experiments concerning metabolism are yet entirely lacking. However all this may turn out, I hold, with Frankl,¹⁰ that all these trials are of relatively little importance, as the changes caused by and following the bath are altogether minimal. Only this can be taken as sure, that the oxygen bath *reduces abnormal augmentation of blood-*

pressure, rate of pulse, and respiration, while the healthy are not more affected than by a corresponding plain water bath of like temperature and duration. As the skin certainly does not contain more blood, this must be directed more toward other areas. And as there are no phenomena whatever that might point to congestions of inner organs, Winternitz's suggestion that the blood is chiefly turned toward the skeleton muscles seems to be acceptable. However this may be, the oxygen bath acts just contrary to the carbon-dioxid tub, which drives the blood toward the skin, powerfully depleting the inner organs.

"Winternitz holds that the prickling sensation in the water is attributable to clonic contractions, and is identical with the pulsation of the skin heart.

"In his first publication Sarason suggested that oxygen might be present as ozone, but according to Schnuetgen all ozone tests were negative.

"It may be plausible to assume that the oxygen is of importance, the more so as it seems to be present in its nascent form. As to this we see, indeed, favorable effects wherever an increased respiratory intake, independent of a bath, is known as being of benefit; here asthma and cyanosis and difficult breathing, incidental to pulmonary congestion, may be mentioned (Naumann ¹¹). Now and then we find a patient who, after entering a full bath, feels oppressed; such cases stand the tub better in its oxygen form.

"An appreciable absorption of oxygen through the skin is inadmissible (Winternitz). Zuelzer, Salomon, and Schierbeck found that the perspiring and hyperemic skin may absorb up to 4 or 5 per cent. of the pulmonary intake, but in the O₂ bath the skin is not hyperemic, and even if the amount were larger, we know, from the experiments of Speck, Lowy, and Durig, that increased ingestion of oxygen does not favor metabolism.¹² Still, according to v. Koranyi (Michaels, Handbuch der Sauerstofftherapie, 1906), it may decrease the viscosity of the blood and thus facilitate metabolism and catabolism.

"Oxygen being one of the most powerful disinfectants, it is obvious that we may expect results due to this effect.

"Independently of the ehemic part of the oxygen, we have to consider the physical effects of the gas bubbles.

"The minute oxygen bubbles, forming and bumping against the nerve terminals, running into one another, driving up and striking along the lanugo, acting like a gas brush, as Sarason aptly pictured the process, exert uniform, mild, and constant stimulation upon the nervous endings, resembling in action a sublime massage. All stimuli of the outer world being excluded, the effect of this ideal overexertion, conveyed toward the nervous centers, institutes a sedative action, almost like the continuous bath,¹ the sovereign calmative effect of which is generally recognized. In conformity with this, we see that all writers on the subject lay stress upon its sedative character in the manifold paresthesias of neurasthenic, hysterical, and tabetic origin and its decided and reliable soporific action. At the same time it has a soothing and indirectly stimulating influence, as is evident in asthma and other respiratory difficulties, and in its distinct corrective action upon pulse irregularities of all kinds, and thus it, doubtlessly, resembles the carbonic acid bath, the outbalanced pulse becoming stronger, slower, and regular.

"In conclusion, we may outline the physiologic action of the oxygen bath thus: (1) It is a neutral bath that (2) acts oxidizingly and disinfectingly upon the skin; (3) it has a powerfully suggestive influence, and (4) alters innervation by discontinuation of paresthesias, by its sleep-promoting peculiarity, and by its generally sedative and indirectly stimulating action; (5) it is a circulatory revulsive, most probably turning the blood from the skin toward the inner body, especially into the muscular areas, and (6) it reduces an abnormally increased blood-pressure, at the same time probably rendering the blood less viscid.

"Though the literature on oxygen gas baths is not voluminous and many points may be still disputable, further experimenta-

¹ Continuous Bath, by Grosse, Med. Brief, 1905. viii.

tion will hardly bring forward new facts of greater importance. Setting aside the cutaneous anemia, with its peculiar lack of goose skin and chilliness, the oxygen bath presents no feature essentially different from other well-studied hydrotherapeutic phenomena, so that, according to the physiologic arguments by which we have tried to analyze the different components, we may state the clinical indication as follows:

"The perogen bath may be given whenever a neutral or indifferent one is indicated, which means a full bath of such temperature and duration as do not change materially the body's inner warmth, that is, of 93° to 98.6° F. (33.8°–37° C.), and of fifteen to thirty minutes; and when we shorten the duration down to ten minutes we may call a temperature neutral, even as far as 90° F. (32.2° C.) and even 88° F. (31.1° C.).

"The gas bath is preferable also when we want to impress a case with potent suggestions. The perogen bath, with its different ingredients, which are to be carefully distributed and dissolved; with its sequent milky turbidity; with its mystic sizzling; with the queer formation of the gaseous tegument, fascinating both eyes and sensibility; with the gradual darkening of the water and its muddy sediment upon the skin; with the puzzling sensation, as if the water suddenly had turned warmer, and last, but not least, with blissfully free respiration, has a valuable multitude of suggestive features. Not only will the horde of hysterics fall in, but also many of the blasé complainants of the wealthy classes, and many half-read persons, who believe they know and understand everything, will thus be induced to bathe regularly and in accordance with our program—details apparently of little importance and yet sometimes extraordinarily valuable.

"It would further be of interest and importance, if the disinfectant power upon germs within the epidermis and its gland ducts were examined in the wards for contagious diseases, as in scarlatina, measles, small-pox; or for microbial skin diseases, as psoriasis, favus, impetigo, certain forms of eczema, and others.

This may be of the utmost value for the prevention of many epidemics.

"Paresthesias located in the body surface are the next indication. So far, the reports seem to deal chiefly with nervous forms, though those chemically caused, such as the most troublesome itching occurring sometimes in liver diseases, are, most probably, not out of question. As another group of parasthesias is apparently characterized by superficial hyperemia, as, for instance, 'burning hands and feet' and local hyperhidroses, I tried local O_2 baths in one case of burning feet of apparently vasomotor origin, with strikingly good effect. Though one case allows of no inference, it is certainly suggestive to think of it in similar cases, the more so as the treatment of this form of anomalies is a crux alike for the physician and the patient. In regard to these and antisepsis, again the suggestions of our osmologists may be noteworthy, as when their advice is followed the oxidizing effect must be multiplied.

"As we have seen, the perogen bath is, furthermore, of a decidedly sedative character, combining with this quality, in contradistinction to drugs, positively a welcome stimulation. It seems to me that this is of an importance that can hardly be overestimated in conditions of excitation, such as is so often met with in persons of rather too liable a nervous system, who are thrown out of balance by every little happening of everyday character. For here, again, the bodily effect is enhanced by suggestion.

"Finally, here may be added the fact that Frank¹⁰ advocates the oxygen bath in a special article on climacteric molimina; 'for the ambulant treatment of which the O_2 baths, as they have been studied by other experimenters, seem to have been predestined.' Of course, anatomic alterations of the pelvic organs, some sufficiently well-known hemorrhages, and climacteric obesity are out of the question here. It is the very same line of vasomotor and nervous disturbances, mostly presenting an increased blood-pressure, from which likewise Dührssen, Engelmann, and others recommend a general hydro- or balneotherapy-

peutic procedure in general, and Gottschalk, Baelz, Grosse,¹³ and others, above other applications, the hot (107° F. — 41.6° C.) full bath for six to eight minutes. In all these means the reduction of blood-pressure is the effect wanted, but even here the suggestive influence should never be excluded.

"This gives me occasion to mention the only contraindication concerning oxygen baths; namely, conditions of low blood-pressure, no matter of what origin. It may also be of value to direct attention to the fact that in rare cases an idiosyncrasy for oxygen has been found. Thus in one patient vomiting occurred, and in a woman, forty-six years of age, suffering from endocarditis and mitral insufficiency, violent heart palpitation has been reported.

"To sum up: Winternitz, the father of hydrotherapy, is right in stating that the oxygen bath forms a new link in the chain of procedures adapted to domesticate hydrotherapy. It is welcome as a substitute for other hydriatic applications, valuable as to innervation and O₂ ingestion, and, above all, entirely new and without parallel as a peculiar circulatory revulsive."

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MUD BATHS AND FANGO PACKS

These are applied for rheumatism, gout, arthritis deformans, and the neuralgias. They act principally through the heat applied, and are, of course, not dependent on absorption of the

minerals contained in the bath, although no doubt the skin is favorably affected by the saline and alkaline substances employed.

Mud Baths.—For these baths the patient lies in a tub containing the prepared mud mixed with a saline or carbonated water. The most famous mud baths are those of Carlsbad, Kissingen, Baden Baden, Leipsic, Vienna, Weisbaden, and Salsomaggiore and Battaglia, Italy. (See also p. 128 *et seq.*)

Fango is an Italian volcanic mud. In color it is a soft grayish brown, plastic, and of about the consistency of butter and equally soft to the touch. It has no odor and after application is quickly and completely removed by a warm douche, leaving the skin absolutely clean. The analysis shows that it is composed of 11 per cent. of combustible and volatile matter with carbonates and sulphates and sulphids of iron and lime, and sulphates of potassium and sodium. It is said to be radioactive.

The fango is applied warm like a great sterilized poultice. It conveys heat and retains it. The pack may be applied first at 110° F. (43.3° C.) for ten minutes, and the temperature and duration increased in successive applications up to 125° F. (51.7° C.) for twenty, thirty, and forty minutes. Gentle massage may be given after the pack.

Applied in this manner to a joint or limb the effects are of the fango bath: stimulation of cutaneous reflexes, with dilatation of superficial capillaries; increased activity in the normal processes of absorption of morbid deposits, and repair of damaged tissues. Perspiration is promoted and there is a slight increase of body temperature, 2° F. (1.1° C.), subsiding rapidly after the removal of the pack, and due to direct conveyance of heat to the blood. Dr. Cecil Sharpe,¹ of London, has recently reported 13 cases of stiff and painful joints treated in this manner.

In subacute rheumatism, lumbago, rheumatoid arthritis, neuritis, sciatica, sprains, and old injuries of the ankle, fango gives good results. Among its advantages are the application only to the part involved, and the fact that these packs are

¹ W. Cecil Sharpe, M. D., *Jour. Balneology and Climatology*, January, 1905.

given in various cities with the mud imported from Battaglia where the fango is found in connection with hot springs.

This treatment can be obtained in Battaglia and Acqui, in Italy; at the Anstalt for Physiologic Therapeutics, University Clinic, Munich; at London, at Smedley's, Matlock, England; at Baden Baden, at Kissingen, Germany; at 69 West 90th Street, New York City, and at Mudlavia, near Attica, Indiana.

MUD AND PEAT BATHS

These are employed in Europe, especially at Franzensbad, Elster, Marienbad, Driburg, Carlsbad, and Buxton, England. The mud baths (*Schlammäder*) consist of a soft mass of in-



Fig. 105.—Moor baths, Buxton. Digging the peat in winter.

organic mud rich in silicious matter. The peat baths (*Moorbäder*) contain both organic and inorganic matter, and, like the mud baths, are applied as immense poultices, either locally or generally at temperatures ranging from 118° to 122° F. (47.7° - 50° C.). These mud and moor baths can be given at higher temperatures because the medium is a comparatively poor conductor of heat. In local applications sand baths may be raised in special cases as high as 133° F. (56.1° C.). These local baths may

also be continued much longer than full baths and are frequently as much as an hour or an hour and a half long; while forty to forty-five minutes suffices for the full bath and forty-five to sixty minutes for the half-bath. Friction is sometimes used in mud and peat baths and the innumerable fine hard substances or spicules, the remains of shells or plants, act as a stimulant to the skin.

Peat baths are used in chronic pelvic affections. Their action is like that of a widespread poultice. They are useful in gout,



Fig. 106.—Moor baths, Buxton. Bringing in the peat in winter.

rheumatism, lumbago, and sciatica. In all neuralgias low temperatures, 113° F. (45° C.), are best.

The peat baths at Marienbad are ferruginous, and those at Driburg sulphurous.

SAND BATHS

These are naturally not hydrotherapeutic measures, but are found at some resorts where other baths are given. It is one means of raising the body temperature and powerfully exciting the skin.

SITZ- OR HIP-BATH

A special tub is required for hip-baths, so that the patient may sit in water with his thighs resting against the front of the



Fig. 107.—Sitz-bath.

tub, and his knees, legs, and feet protected by a blanket, while the latter are in warm water. The top of the patient's head is

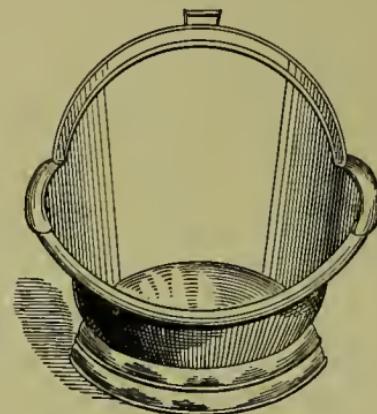


Fig. 108.—Sitz-bath tub made of tin (Ashton).

covered with a cold wet cloth and the tub is partially filled with water. The temperature of the water can be raised or lowered as required. If necessary to raise the temperature above 104° F.

(40° C.) pitchers of hotter water can be added cautiously; if, on the other hand, it is necessary to lower the temperature, cold water can be added. In the latter case quick friction of the submerged portions is required. The hot bath raises the pulse and lowers the pressure, the reverse being the case when cold water is used. The results are largely due to reflex excitation of the sympathetic nervous system. The hot bath diverts



Fig. 109.—Sitz-bath with abdominal friction (Gant).

blood from the abdominal organs, while cold baths produce congestion. Hence, in all atonic states of the bowels, urinary and generative organs cold acts a stimulant if the baths be short and friction be applied. If such baths be prolonged, the stimulant effect is not obtained.

It should be remembered in giving the sitz-bath carefully to cover the unimmersed parts of the body, otherwise the effect may be entirely annulled, especially in intestinal affections.

In menstrual disorders warm and hot sitz-baths are often

corrective.¹ Brief cold hip-baths are useful in vesical and intestinal paralysis, in debilitated states of the male sexual organs, in prolapsus ani, and in intestinal atony.

Prolonged cold hip-baths are advocated by Misiewitz in hemorrhagic states of the urethra, bladder, intestines, and uterus; in hemorrhoids and in perimetritis.



Fig. 110.—“Lisbon” seat bath (J. L. Mott Iron Works).

Counterindications.—These baths are counterindicated in hyperemic states or congestions of the pelvic organs; in sexual or vesical irritability, in seminal emissions, in tenesmus, in menorrhagia, in uterine colic, in acute cystitis, and in intense tenesmus.

PACKS—COLD WET PACKS (FEUCHTE EINPACKUNG). HOT WET PACKS. DRY PACKS (TROCKENE EINPACKUNG)

Packs were first used, as far as known, by Lucas, an English physician, who lived about the middle of the eighteenth century.

¹ See page 226. For a full discussion of hydrotherapy in diseases of women, see Ashton's Practice of Gynecology, 4th ed., 1909; also Bandler's Medical Gynecology, 2d ed., 1909.

Later, about 1835, they were rediscovered and used by Vinzenz Priessnitz, of Gräfenberg.

These procedures, apparently so dissimilar, are very closely related, not only in their visible form but also in their physiologic effect. An aphorism of Hippocrates was that cold produces heat, and this simple statement comprises one of the greatest and most fundamental truths in physiologic therapeutics. It was a remarkable mind that was able to grasp and to express over two thousand years ago what even now seems so paradoxic.

One of these curious paradoxes in the practice of hydrotherapy is the fact that after the removal of the cold wet pack the damp sheet is found warm; while after the removal of the hot blanket pack, as, for example, in cases of chronic nephritis or the nephritis of pregnancy, the damp blankets are sometimes found to be cool. (See p. 118.)

Bed or Table for Applying Packs.—In applying a pack it is convenient to have a narrow bed or table of substantial construction, such as that shown on pages 235 and 236. This bed or table may be of iron tubing with a strong spring to support the mattress; or it may be of wood with stout legs and a plain top and not intended for a mattress, but for blankets and sheets. This is the type of table used for massage and commonly for packs and alcohol rubbing. For packs of long duration the narrow iron bed with springs and mattress is the more comfortable for the patient. A high table is convenient for the operator, but a low bed is safer for the patient should he belong to that class of mental or refractory patients for which such measures are much employed.

The bed and mattress are protected with a rubber sheet, and on this a large blanket is spread long enough to reach from the nape of the neck to beyond the foot of the bed, and wide enough to hang over the side. A hair pillow, covered with white rubber cloth, and a pillow slip is placed at the head.

COLD WET PACK

Requisites.—The bed or table prepared as above. One or two additional blankets; a linen or cotton sheet; 4 small towels, and a hot-water bag. The bag is half-filled with hot water, not over 120° F. (48.9° C.). A foot-bath is required with water at 102° to 105° F. (38.9° – 40.6° C.). A pitcher of ice-water, a bucket of water for the sheet at 65° or 70° F. (18.3° or 21.1° C.), or at the required temperature.

Technic.—The patient in wrapper sits in a convenient chair with feet in the bath of warm water and with a cold compress on the head. The attendant then wrings out the sheet from the water in the bucket and spreads it smoothly over the bed, so as to reach near the foot. The patient then quickly drops all clothing and lies on the wet sheet with the arms extended. The attendant, standing on the right side, promptly draws the overhanging left side of the sheet across the body, smoothing it between the lower limbs and along the right side. The arms are then lowered to the sides and the remaining free portion of the sheet is drawn over the body and smoothly adjusted over the lower limbs, covering in both arms. The feet are left uncovered by the sheet, but the hot-water bag, covered with a towel, is placed at the soles. The underlying blanket is adjusted in a manner similar to the sheet, except that it is not tucked between the lower limbs, and the surplus at the feet is folded under them. The blanket should be closely adjusted at the neck *so as to exclude all air*. Another blanket, folded in several thicknesses, is then placed over the entire body from the neck down and tucked snugly in at the sides. A fresh turban of ice-water is adjusted, to be changed every five minutes as it warms.

It is found in many cases that if the wet sheet is allowed to extend beyond the feet and is then placed over the feet without the use of the hot-water bag, the reaction in the feet is slow and correspondingly unsatisfactory. There is no advantage in covering in the feet with the cold wet sheet, and the use of the hot-water bag favors the action of the pack.

THE HOT WET PACK

This is applied in three principal ways: viz., by means of a sheet wrung out of hot water; by means of a blanket wrung out of hot water; and by means of both. In many cases, especially in treating children, the first method suffices, and it avoids the necessity of dealing with wet blankets.



Fig. 111.—Adjusting the first half of sheet.

Requisites.—These are the same as for the cold wet pack, excepting that a bucket of hot water should be provided. The bed is protected as previously described and on it two blankets are spread.

Technic.—The sheet, having been wrung out of the hot water, is then unfolded and laid on the upper blanket. The patient is

then placed in bed quickly, the sheet quickly losing sufficient heat to make this possible. The sheet should not extend beyond the junction of the head and neck.

While the patient's arms are raised, one side of the sheet is quickly drawn across and tucked under the opposite side and folded between the lower limbs; then the arms are lowered in



Fig. 112.—Patient enveloped in the sheet.

the cold pack, and the remaining side of the sheet is carried across and smoothly applied, enclosing both arms and lower limbs. The hot-water bottle, suitably guarded, is placed at the feet, and the upper blanket is then adjusted as in the case of the cold wet pack. After that the under blanket and the free ends of the coverings are folded under the heels. In from twenty to forty minutes perspiration forms on the forehead and

the body temperature will be found from 1 to 2 degrees higher than at the start.

After a tepid or cool sponging the patient is dried and removed to bed, which has been previously warmed. The bed-clothing should be fairly light.



Fig. 113.—Adjusting the first half of first blanket.

Indications.—This pack has innumerable uses, especially where defective metabolism is met with. It is well suited for the young, the weak, and the aged. Dr. Leonard Williams, of London, has advocated it strongly in anemia, in the sequelæ of scarlet fever, and in the slight catarrhs of the air-passages in children. For the convulsions of children it is far neater, more agreeable, and quite as effective as the hot bath. The child is kept quiet and his head is more easily kept cool.

In uremia the hot wet pack is also useful. (See p. 117.)



Fig. 114.—Patient enveloped in first blanket.

Many a case of puerperal convulsions has been saved by this procedure.

DRY HOT PACK

The dry hot blanket pack is commonly used after the warm douche and warm or hot baths in the treatment of gout, rheumatism, syphilis, and obesity.

COMPRESSES

Action of the Compress.—When inflammation with arterial venous congestion occurs in a given part there is a corresponding compression of the nerve trunks by the overfilled blood-vessels.



Fig. 115.—Hot dry pack, Hot Springs, Virginia.



Fig. 116.—Reapplying the wet cold turban in the hot dry pack.

Spasim of the nutrient vessels, by which the nerve filaments are compressed, has also been supposed to account for the pain. If the blood may be diverted to the surface or to some other part by the use of compresses, relief will be afforded. (See pp. 210 and 213.)

Materials.—For the cold compress the material used is linen, which is then covered closely by several thicknesses of flannel to prevent outward radiation. For the moist hot compresses well-soaked flannel is used, covered, as in the former case, with a sufficient layer of dry flannel.

COLD COMPRESS

The good effects of a cold compress are well seen in the treatment of pneumonia. (See p. 100 *et seq.*) The water should be at 50° or 60° F. (12.8° or 15.6° C.). The linen compress, 18 inches wide, partly wrung out, is laid smoothly over the affected side, extending slightly beyond the median line, front and back, and is then covered with a flannel binder, applied somewhat loosely. The compress should be changed night and day every hour, and it is possible to do this without much disturbance to the patient.

Indications.—The danger in cases of pneumonia lies in the possibility of intoxication, but as a general thing this is not so great as in typhoid; full baths are, therefore, not desirable. The failure in peripheral circulation causes hypertension of the heart, the blood being driven to the inner parts, and it is just here that the compress gives timely assistance. The cold stimulates the heart, and with the systole blood is driven into the peripheral vessels. The central nervous system is also invigorated by the effect of cold on the capillaries through the muscle-fibers of the skin. As the skin reacts and the peripheral circulation improves, the heart beats slower and stronger and the increased force and tension of the pulse are shown in the kidney; the urine excretion is also increased. The crisis is hastened and is marked by a drop in the temperature and a notable improvement in the rate and character of the pulse.

The use of ice in pneumonia rests upon the same basis. The end sought is not the reduction of temperature, but a check to the intoxication by improved circulation and consequent nutrition. It is possible that by these means antitoxins are developed to counteract the infection. The crisis in pneumonia is sudden and not fully to be explained. The remarkable effects cannot be accounted for by immediate changes in the physical condition of the lung. If so, hydrotherapy would be powerless; it is, therefore, a mistake to expect the compress to cure the condition of the lung itself. If the patient recovers, he does so in spite of the pulmonary consolidation; if he dies, it is not altogether from the encroachment on his breathing capacity, but from the intoxication.

Put two intoxications together, as that of alcohol and pneumonia, and the result is usually fatal. As a rule, it is not best to give alcohol in cases of pneumonia treated with compresses, but in alcoholic cases some alcohol may properly be given, but it requires wise judgment to decide when to give and when to withhold. As in any other form of treatment, little can be expected from these measures in alcoholic cases, especially if treatment be started late, as, for instance, on the third day. (See chapter on Pneumonia, p. 100.)

ICE COMPRESSES

The application of ice to the body is best made by means of water-tight rubber ice-bags, as it is obviously best to prevent wetting the bed and the patient's clothing. As stated above, the aim is not to reduce the inflammation, for the lungs of a living man would not be appreciably affected by cold applied outside the chest wall.

FOMENTATIONS¹ OR HOT COMPRESSES

Moist heat may be easily applied to the body by means of hot flannel compresses. Unless very hot compresses are used

¹ It is tautologic to speak of *hot* fomentations. They are simply the application of moist heat by means of cloths.



Fig. 117, *a* and *b*.—Wringing hot compresses (Cohen).

it is better not to interpose linen or cotton, but to have the flannel in direct contact with the skin. The compress must be very thoroughly wrung out of boiling water. This temperature may be less at first. This induces hyperemia of the skin and relieves internal congestion. The compress should be covered with several folds of flannel to prevent external radiation.

Indications.—Fomentations or steam compresses have a wide range of usefulness. They give relief in almost any condition in which pain is a symptom, especially in those conditions independent of inflammation. When inflammation is present in the abdominal cavity, however, surgeons usually prefer to employ ice or very cold applications. (See p. 158.) Hot compresses favor suppuration, promote the absorption of exudates, relieve pain, and increase the mobility of stiffened joints. In all cases of rheumatoid arthritis, in arthritis deformans with pain and swelling, in sprains, bruises, cramps of the extremities; in biliary, renal, and hepatic colic; in affections of the bowels and pelvic viscera and in intercostal neuralgia, lumbago, and sciatica moist hot compresses are exceedingly useful.

Counterindications.—Fomentations are not to be used when appendicitis threatens, or in cases of peritonitis, whether idiopathic, due to perforation of the bowel, or to injury. Pending operation, suppuration in such cases should be fought with cold. So also at the onset of pneumonia. In such cases ice-bags, cold compresses, and such measures, elsewhere noted, are much more stimulant to the vasomotor centers and are superior to the general application of heat.

Technic.—The illustration shows a convenient method of preparing a steam compress. Several layers of white flannel, of a suitable size and fastened together, are dipped into boiling hot water. The area to be treated is then covered with a thin layer of dry flannel, the so-called *baby flannel* answers the purpose best. The wet compress is now dropped into a towel, and twisted lightly, so as to leave it comparatively dry. It is then

unfolded, placed over the dry flannel referred to, and the whole enveloped in a dry flannel binder.

The following is Dr. Curran Pope's¹ graphic description of the application of a hot compress:

"I will now simplify my apparatus by limiting it to a basin, two towels, and a tea-kettle filled with *boiling* water. The majority of hot applications fail for two reasons. In the first place the application is *too wet*, and in the second the hot application is *too cold*. Hot applications should range anywhere between 125° and 165° F. (51.7° and 73.9° C.). You cannot handle them with your hands, in fact, they are too hot for you to pick up and hold at all. If you put these applications on the patient's skin *too wet* they blister. If you put them on only warm you lose two-thirds of the benefit of the treatment.

"Suppose that we are going to make a hot moist application or fomentation to the pelvis, where we want all the heat we can get. It is best to use a Turkish towel or a small piece of blanket. If you can't get that, get a piece of an old flannel petticoat. Take this and place it right in the center of your towel. Now you have everything ready, and the mistress of the house brings in the tea-kettle full of boiling water. If you were to place it on the patient without previous preparation, you would burn her. Place around the hips, pelvis, and lower abdomen a folded blanket, so applied that the ends overlap in front. Now rub the surface to be covered by the fomentation with vaselin.² This prevents maceration or softening of the superficial epithelial layers. Having poured the boiling water over the flannel that lies in the towel, so hot that you have to keep back, two persons commence twisting the opposite ends of the towel and keep twisting until all or nearly all the water has been removed. We have in this towel, we will say, a piece of flannel at a temperature of 165° F. (73.9° C.), and what does the nurse now do? She picks up the towel containing the flannel, goes to the bedside,

¹ Kentucky Medical Jour., December, 1908.

² The use of vaselin in this case does not warrant its use when dry heat at much higher temperatures are used, as in "baking."

rapidly unrolls the towel, and places the hot flannel in place upon the bare skin. If the patient howls, lift it up for a second, and then put it back again. Just as soon as the patient can tolerate the high temperature, the fomentation is covered by the blanket, which is pulled as tight as possible to prevent the entrance of the air. There is very little risk of burning if plenty of vaselin has been used.

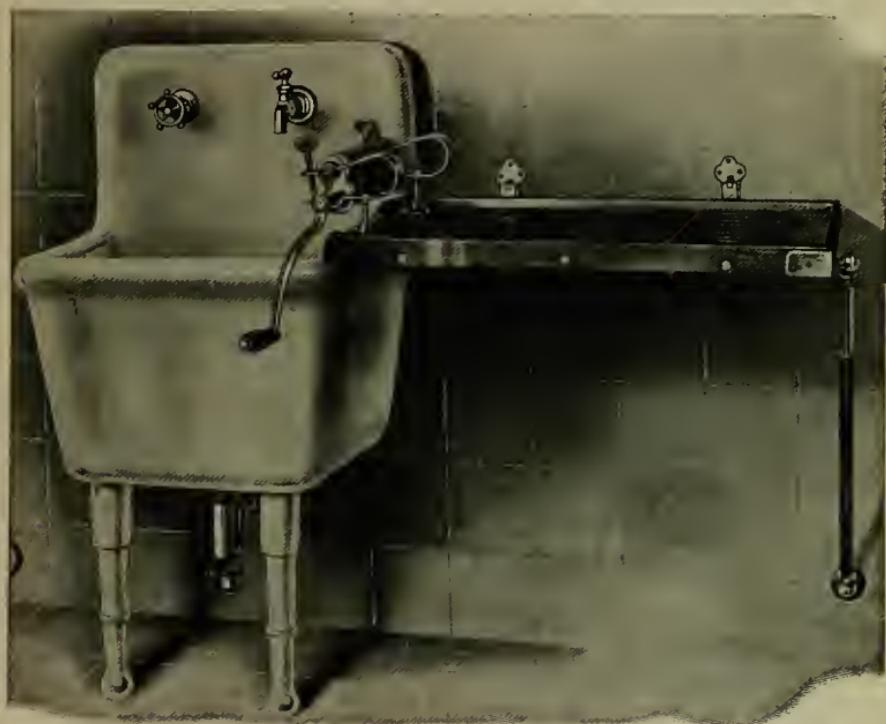


Fig. 118.—The Clow fomentation sink.

"Usually in less than sixty seconds you will get a relief that can be gotten from no other application that I know of.

"These two procedures any doctor can use. It does not make any difference where he is or how he is situated."

A little ground mustard added to the hot water intensifies the action of the fomentation.

Dry and moist compresses require frequent change to be effective, and if applied directly to the skin should be tested by the physician or nurse before applying to the patient.

For pain, renewal may be made every minute or two; in less severe cases every three minutes, having a fresh fomentation ready to apply before removing the one in place.

Apparatus.—In hospital practice it will be convenient to have a fomentation sink with wringer and drain-board, as seen in Fig. 118.

A simple invention for preparing compresses is described in the *Lancet*,¹ under the name of Haden's Patent Compress Heater.



Fig. 119.—Applying a fomentation to the spine.

As will be seen in Fig. 120, it consists of a vessel in the shape of a truncated cone, and a pan, perforated in its central part, which fits into and extends beyond the rim of the smaller end of the cone-shaped vessel. The diameter of the pan is about 9 inches, the perforated part measuring 4 inches across. To each of the two parts of the apparatus is affixed a wooden handle which allows of their being moved about without risk of

¹ Haden's Patent Compress Heater, *Lancet*, London, April 3, 1909. Manufactured by Mayer and Meltzer, 71 Great Portland Street, W., London, England.

burning the hands of the user. Water is put in the lower part of the apparatus, the compresses or other articles are placed upon the upper tray, and the whole stood over a fire or any form of heating appliance. It will be found that the steam arising from the water heats the compresses almost instantaneously, and all risk of scalding the hands is avoided, as no wringing is required. Another point worth noting is that in the absence of a properly trained nurse the time of the medical attendant is saved in making detailed explanations and emphasizing the risks of scalding when compresses or fomentations are to be prescribed. The appliance should be really useful in hospitals in which fomentations are constantly being applied, for, as all

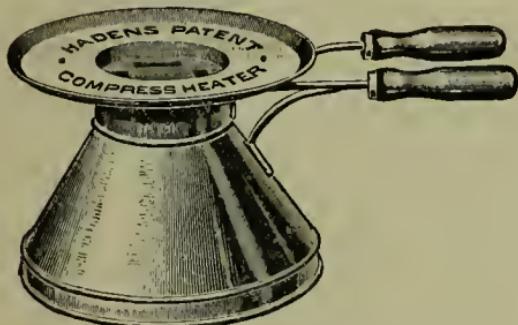


Fig. 120.—Haden's patent compress heater.

former surgical dressers are aware, the preparation of an effective fomentation by means of the old-fashioned "wringer" is attended by considerable inconvenience. For hospital use the heater is made of stout copper, and for less frequent employment it is made of tinned iron at a smaller cost. In the fomentation sink the water is kept boiling by a current of live steam passing through the water.

In private practice a large pail answers well, or, in its absence, a basin or a tea-kettle filled with boiling water. There will also be needed two or three towels and, if possible, a piece of white flannel about a yard square. A Turkish towel and a piece of blanket can probably be obtained. (See Figs. 124, 125.)

Precautions.—In any case where the parts are insensitive, either from anesthesia due to disease or to the use of chloroform or ether, or if benumbed by cold, care should be exercised not to apply fomentations at too high a temperature or too wet. Cold should always be applied to the head. The fomentation should be removed before it has time to cool and the turban at the head may be used to wipe off the part that has been treated. This quick use of a cool cloth will enhance rather than diminish the effect of the fomentation. The part should then be quickly dried and covered with night clothing.

HOT AND COLD TO THE SPINE

Fomentations to the spine may be applied alternately with cold sponging. This process is commonly referred to as "hot and cold to the spine." It has long been used by Dr. S. Weir Mitchell and other neurologists in the treatment of hysteria, neurasthenia, and the irritable spine.

The method used varies in different hands. The simplest is the alternate application of two sponges, one dipped in hot and the other in cold water. Or three fomentations may be made, each followed by a sponging with ice-cold water. Each fomentation remains in place three minutes; each sponging consumes fifteen seconds.

SALT RUB OR SALT GLOW

Requirements.—A tub of salt water at 104° to 105° F. (40°-40.5° C.) and a box containing finely ground salt. Aston's English salt is suitable. A small handful of the salt is dampened in salt water or other convenient water, and the patient is rubbed more or less vigorously by the attendant. After a thorough rubbing, the patient is washed off with a rose carrying warm water, which is gradually cooled to the desired temperature. A bath in the full tub may follow this, or may take the place of the spray, and the patient should then be well rubbed with cocoanut oil for fifteen minutes.

THE ICE RUB OR ICE IRONING

In this procedure flat pieces of ice, held in gauze, are rubbed over the body and limbs. It is used in connection with sprinkling and is sometimes advocated in serious cases of sunstroke (see p. 92).



Fig. 121.—Ice rub.

The **ice-poultice** is made by mixing finely broken ice with dry Indian meal or fine sawdust.

COLD APPLICATIONS UNDER THE HEART

Ice to the Heart.—This means of combating fever is called by Deléarde and Dubois precordial frigo-therapy.¹ They use it in typhoid fever and other infectious diseases, except tuberculosis. It is applied day and night throughout the continuance of the fever.

In the use of cold for children it is especially necessary to

¹See *Gazette Médicale Belge*, June 18, 1909.

begin moderately. Place the ice-bag to the head and a warm-water bag to the feet. Then if desirable, when temperature remains high, place the child on a blanket and remove the clothing, except the diaper, and sponge with water at 90° to 95° F. (32.2°–35° C.) for ten minutes, beginning with the face and taking up the body and limbs in turn. It is well to allow a little evaporation. Successive baths at 80° and 70° F. (26.6° and 21.1° C.) may later be used, as judgment dictates and as confidence is obtained; children will gradually submit to these measures.



Fig. 122.—Cold abdominal or Neptune girdle (Gant).

NEPTUNE'S GIRDLE

This is really an abdominal compress made with broad linen, folded in several thicknesses, and sufficiently long to pass around the body and overlap in front, so that the abdomen is covered

by several thicknesses. The binder is previously soaked in water at 60° F. (15.5° C.), wrung out, and applied as described; then covered with flannel, overlapping the bandage above and



Fig. 123.—The ice-coil in position (Gant).

below, in order to prevent access of air and chilling. The linen and flannel should be drawn up snug and securely fastened.

The **ice-coil** accomplishes very much the same purpose. Winternitz combined both these measures, placing the coil above the compress.



Fig. 124.—Simple method of wringing out fomentations (Gant).



Fig. 125.—Method of applying fomentations (Gant).

SWEDISH SHAMPOO

This is a vigorous scrubbing with soap and water, and is a feature of the Turkish bath. The *Egyptian loofah* is used, and stimulates the skin much better than sponges, towels, or the bare hand. The Swedish shampoo is commonly used after the warm full bath, and commends itself to a wide variety of cases. It has been employed in toxic cases and in asylum work with great success.

RECTAL AND COLONIC RECTAL IRRIGATION

This is a valuable adjunct to hydrotherapy, and is used in a wide range of affections, both medical and surgical. Most gastro-intestinal affections may be relieved by irrigation, but for chronic affections, such as chronic constipation, there is some liability to overdo the method, impairing the tone of the rectum and the natural expulsive power.

Rectal tubes, and longer tubes for insertion into the colon, may be used. It is highly necessary, however, when satisfactory drainage is expected, that provision be made for a return flow. There are several two-way rectal tubes, made of glass, metal, or pressed rubber.

An excellent example of the improved rectal tube is that devised by A. L. Wolbarst, of New York. It is made of nickelplated brass tubing, with a soft-rubber tip; the total length is 7 inches, including the rubber tip. The diameter is equivalent to 38 of the French scale. The soft-rubber tip projects $1\frac{3}{8}$ inches

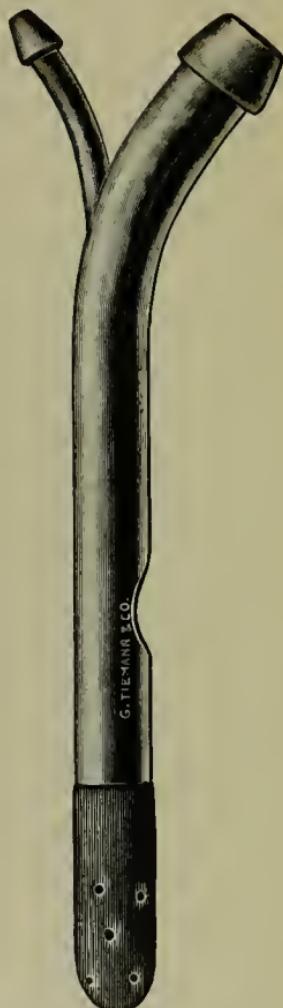


Fig. 126.—Perspective view of the Wolbarst improved rectal irrigating tube; two-thirds natural size.

beyond the end of the large tube; it is slipped over the bulbous end of a short metal tube, the distal end of which is provided with a male thread, which is screwed into the end of the large tube (Fig. 127, C), and thus securely wedged in place. We are also thus enabled to unscrew the rubber tip and thoroughly clean it and the metal tubes at will. The tip of the instrument is of soft, pliable rubber, which gives easily on contact with the rectal wall, and the flow of fluid into the rectum is through a number of small openings, thus providing a fountain spray instead of a single or double jet.

The apparatus consists of two tubes, a small one inside of a larger. The water enters through the small tube (Fig. 127, A) and fills up the soft-rubber pouch (Fig. 127, B), which is perfor-

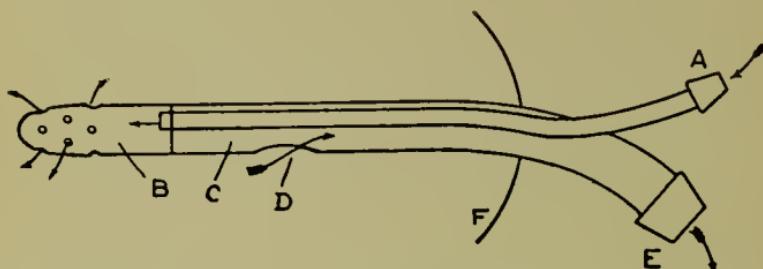


Fig. 127.—Sectional view of the Wolbarst improved rectal irrigating tube.

ated with numerous pin-head openings, through which the fluid enters the rectum. Escape from the rectum is only possible through the large opening (Fig. 127, D) in the larger tube. The external sphincter (Fig. 127, F) prevents any out-flow at the anus.

In cases where there is an inflamed and tender prostate, this tube will be more comfortable and satisfactory to the patient than a rigid instrument.¹

Colonic irrigation is especially useful in pediatric cases. It is best to start with water slightly below the patient's temperature. If the temperature of the child be 102° F. (38.9° C.), start at 95° F. (35° C.), and in the course of ten minutes reduce the temperature of the fluid to about 75° F. (23.9° C.). The

¹See Jour. Amer. Med. Assoc., 1909, vol. liii, p. 384.

object to be attained is not merely the reduction of temperature, but the removal of the products of intestinal decomposition. Even in the presence of typhoid fever good clinicians see no objection to its use as frequently as once in three hours.

Tympany is usually relieved by this method, and the normal salt solution, at very moderate pressure, from 8 to 18 inches, tends to reduce quantitatively toxic contents of the bowel. This method has great value in the treatment of appendicitis pending operation or where surgeons are not available.

PROCTOCLYSIS

Dr. John B. Murphy, of Chicago, has recently advocated a gradual method of introducing water into the rectum under the name of proctoclysis. This permits from 50 to 80 drops per minute to escape at very low pressure.

Iverson Apparatus.—A simple apparatus for this process is one devised by Dr. M. Iverson, of Stoughton, Wisconsin, of which Fig. 128 is a diagram.¹ The parts of this instrument consist of a fountain syringe or irrigator (*a*), a stop-cock (*b*), a Y-shaped glass tube (*c*). From the latter a long rubber tube, ending in a hard-rubber or glass tip, extends downward, and another piece of tubing extends upward, ending in a U-shaped glass tube (*d*), the open end of which projects into the irrigator. An 8-candlepower incandescent electric drop-light (*e*) is all that is necessary to maintain the temperature of the saline solution.

The stop-cock is set so as to permit a flow of from 50 to 80 drops a minute. The vent tube leading from *c* to *d* permits the

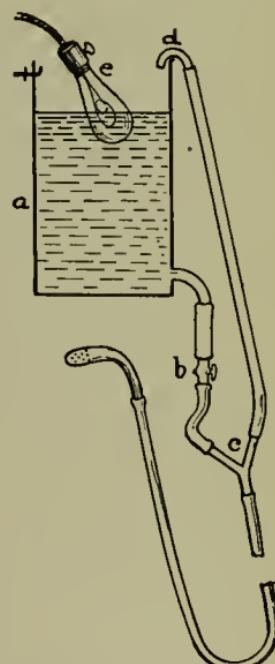


Fig. 128.—Iverson's apparatus for proctoclysis.

¹Jour. Amer. Med. Assoc., June 12, 1909.

back flow of liquid or the passage of gas when the patient strains. The container should be from 4 to 14 inches above the level of the buttocks.

Dr. Murphy employs this method in the treatment of peritonitis, whether postoperative or otherwise, and in general

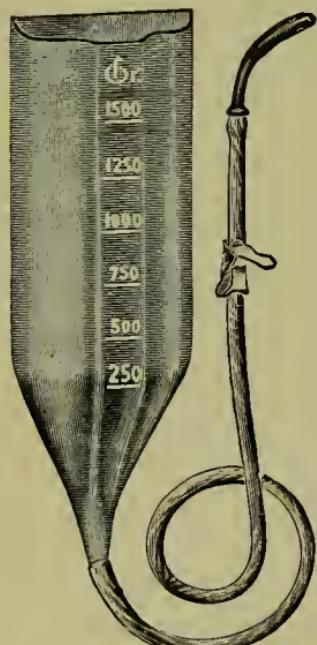
toxemic conditions. Its value depends on the absorption of large quantities of water by the intestine, and this is possible only when small quantities are continuously supplied at a uniform heat under very moderate pressure. Hyperdistention causes spasm and expulsion of the fluid supplied, and it must be avoided. The apparatus already described fulfills these requirements, but any fountain syringe may be used if it be provided with a vaginal hard-rubber or glass tip, flexed at an obtuse angle 2 inches from its end, as seen in Fig. 129.¹ The tip should be inserted into the rectum, so that the angle fits closely to the sphincter. The tube may then be bound firmly to the thigh with adhesive strips, so that it cannot be expelled.²

Fig. 129.—Proctoclysis apparatus, consisting of fountain syringe, large rubber tube, and vaginal hard-rubber or glass tip.

The bag or container is suspended near the foot of the bed, so that the base is 6 inches above the level of the patient's buttocks. The solution advised by Dr. Murphy consists of a dram each of sodium chlorid and calcium chlorid to the pint of water. This is placed in the reservoir and kept at a temperature of 100° F. (37.7° C.) by the most convenient method—electric-light bulb, thermos bottles, thermolytes, or a metal chamber having an electric-heating unit and rubber tube, as illustrated below.

¹ See Journal Amer. Med. Assoc., April 17, 1909, pp. 1248-1250.

² See Kelly and Noble, Gynecology and Abdominal Surgery, vol. ii, p. 415.



The quantity administered depends on the severity of the case, the age of the patient, and other considerations that will suggest themselves in the particular instance. The average, however, is 18 pints in twenty-four hours; that is, $1\frac{1}{2}$ pints every two hours. A quantity less than 8 pints is of little



Fig. 130.—Elbrecht's apparatus, representing a metal heating chamber, block tin lined, with opening for electric heating unit and rubber tube connections for intake and outlet of saline solution. (One-third size.)

value. In a child of eleven as much as 30 pints have been administered in twenty-four hours without escape of fluid. The control of the flow should never be governed by knots in the tube, forceps clamped thereon, or small openings in the tip. The larger tube with many openings is used to provide for a sudden return

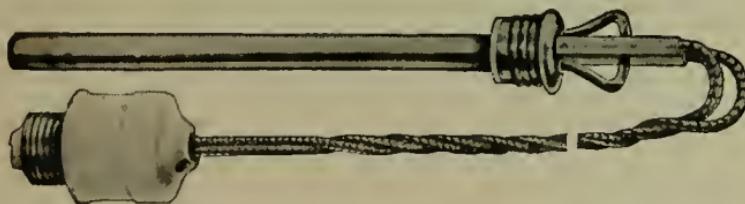


Fig. 131.—Electric heating unit with socket connection and 10 feet of cord. This unit can be used with either alternating or direct current, 105 to 128 volts. (See Fig. 130.) (One-third size.)

of the flow into the can when the patient strains, wishes to expel the fluid, or void gas. If there be constrictions in the tube the fluid cannot return into the can, but passes into the bed-linen.

Elbrecht Apparatus.—A more elaborate form of apparatus is that devised by Dr. O. H. Elbrecht, of St. Louis, and manufactured by the Meier Dental Manufacturing Company of that

city (Figs. 130-137). Dr. Elbrecht describes his apparatus as follows:

"The proctoclysis heating apparatus illustrated was designed to meet a demand for an outfit that would heat saline and maintain it at a uniform temperature for proctoclysis. Many varieties of heating devices have been employed, but all are found wanting, in that they fail to maintain a uniform tempera-



Fig. 132.—Heat unit for alcohol or Bunsen burner flame with regulating piston. For use where electric current is not available. (See Fig. 130.) (One-third size.)

ture when heat is applied to the saline reservoir, for the saline is ever changing in amount as a result of absorption, and thus brings about ever-changing temperatures. Then also there is a great loss of heat in the rubber tubing from the burner or alcohol lamp in connection with the heating chamber, which is then placed on a small table alongside of the bed (Fig. 137).

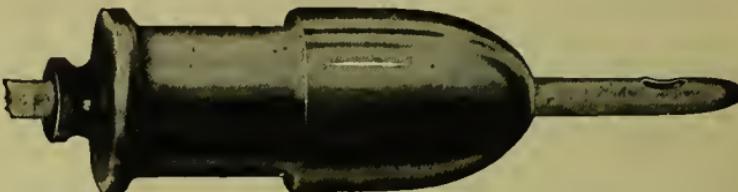


Fig. 133.—Self-retaining rectal tips on catheter, showing how adjustment can be accomplished by merely drawing catheter through to desired length. (One-half size of largest rectal tips.)

This permits the outfit to be used where electricity is not available, as in rural districts or in homes where only gas is at hand. All the parts, including saline tablets, are assembled in a box, which makes the apparatus portable and ready for immediate use in emergencies."

Dr. Elbrecht's apparatus works admirably in adults. It can be used with the angled vaginal douche-tip as well as with the

bulb-tip inserted in the rectum. The tip may be better than the bulb, as the latter occasionally produces irritation and the



Fig. 134.—Pinch-cock used entirely to close flow or for drop method. (One-half size.)



Fig. 135.—Self-retaining rectal tips made in four sizes of hard rubber with opening through center to admit a soft-rubber rectal catheter, American size, No. 15. (See Fig. 133.) (One-third size.)

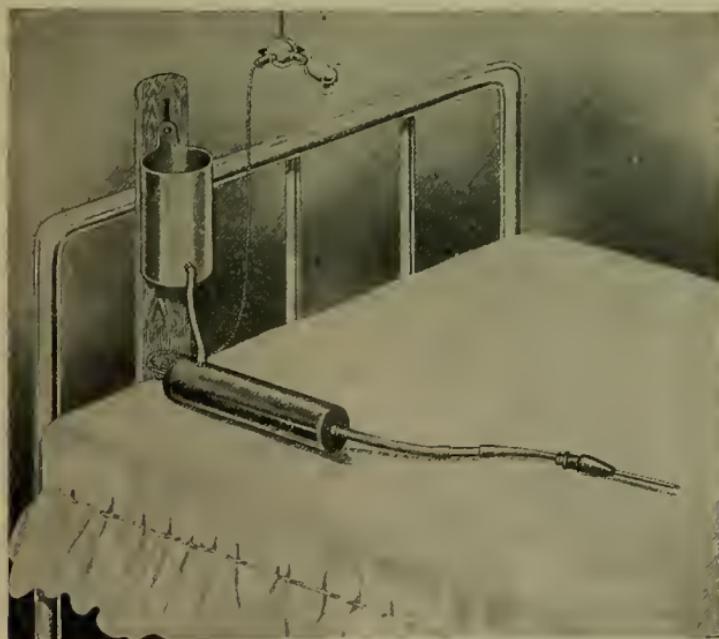


Fig. 136.—Elbrecht's apparatus: Electric heater in operation, showing it properly connected. A short glass tube connects catheter to rubber tubing.

patient insists on having it removed. For the maintenance of uniform heat the Elbrecht apparatus fulfills all the indications.

It does not, however, allow the fluid to flow back when the patient strains. The holder of the Elbrecht apparatus may be inserted into the ordinary fountain syringe can containing hot water, and that keeps it at a uniform temperature and moderately warm for a long period of time.

Dr. Gordon J. Saxon has devised an apparatus, which consists of a copper bucket standing on substantial brass legs, to contain boiling water; with a handle to suspend; a lid to pre-



Fig. 137.—Elbrecht's apparatus: Alcohol or gas heater in operation, showing it properly connected. A short glass tube connects catheter to rubber tubing.

vent excessive heat radiation; faucet at side for the quick emptying of contents for purpose of replenishing with hot water; a circular opening at bottom provided with rubber washer; a graduated jar of 1000-cc. capacity, to receive the salt or other solution at about 140° F. (60° C.), its off-flow protruding through the opening and pressing firmly against the washer, while the jar is held in position inside by a metal frame and clamps.

The off-flow tube consists of two sizes of rubber tubing fitted

within each other, but separated by asbestos wrapping between them to retain heat. At the end near the glass rectal nozzle a thermometer is interposed for the frequent reading of the temperature of the solution at that point and as a guide to the rapidity of the flow. If the flow be too slow, the mercury falls, and if too rapid, the mercury rises.

About 12 inches from the outlet of the jar a Y-tube is interposed, of which the free part (shunt tube) is connected to a receiving glass bottle open at top (shunt bottle), which is secured to the side of the bucket. The purpose of this shunt bottle is

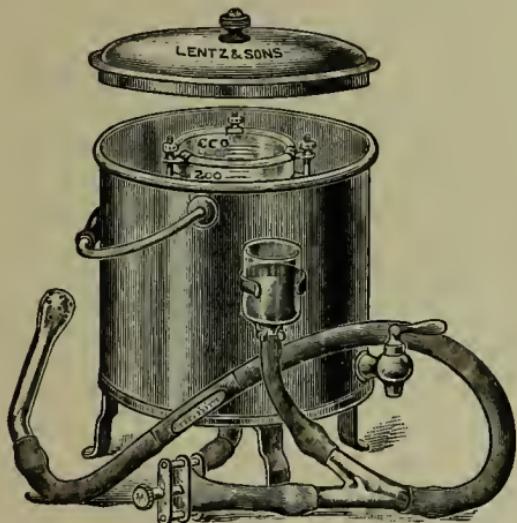


Fig. 138.—Saxon's apparatus for proctoclysis.

to permit the ready expulsion of solution or flatus. *For the control of the flow a pinch-cock is placed between the outlet of the solution jar and the Y-tube.*

A glass float is also provided in order to more readily estimate the quantity of solution retained in jar, in a room where the light is subdued and the graduations on jar not distinctly visible.

The purpose of the apparatus is to keep the solution to be introduced at an almost even temperature, so that it will enter the rectum at a temperature of between 105° to 115° F. (40.5° – 46.1° C.), even during application lasting a number of hours.

According to experiments, it will not be found necessary to change the warming fluid more often than once in two to two and one-half hours.

Directions for Use, as Suggested by Dr. Saxon.—“Fill the warming chamber with boiling water. Fill the reservoir with salt solution at about 120° to 140° F. (48.8° – 60° C.). Open the pinch-cock and allow the fluid to flow freely until the tube is well warmed. Close the pinch-cock until about 2 drops per second are flowing. To judge this, hold the rectal tube point upward not more than 4 inches below the level of the water in the reservoir; otherwise one will be deceived by the rapidity with which the tube will empty itself distal to the stop-cock when the rectal nozzle is held too low.

“Place the rectal tube—of the type directed by Murphy—in the rectum and strap to the inner surface of the thigh. Place

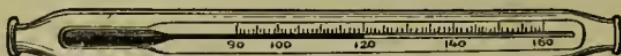


Fig. 139.—Irrigating or infusion thermometer for measuring the temperature of saline solution, or by cutting the rubber tube it can be inserted between the irrigator and the patient by slipping the tube over each end of the glass tube that holds the thermometer.

the apparatus on an adjustable stand or chair, 4 to 10 inches above the level of the anus. A curved glass douche nozzle with multiple openings answers very well the purpose of a rectal tube when the patient is supine. The flow should be just within the internal sphincter.

“If the solution be expelled into the bed or back of the shunt bottle, the apparatus may be lowered, thereby decreasing slightly the rate of flow. If the patient persists in expelling the solution, discontinue the treatment for one hour and then proceed as before.

“In order to save the patient the excitement incident to preparing and adjusting the apparatus, it will be found desirable to make all preparations before entering the patient’s room, so as to be ready for instant use when approaching the bedside.

“To do this, fill the reservoir with solution as directed and

allow the flow to begin. Place the rectal tube, point upward, about 1 inch below bottom of apparatus. Reduce the rate of flow by means of the pinch-cock until the solution can be seen to be making slow progress upward in the upheld rectal tube. This will be drop by drop. Place a hemostat on the rubber tube

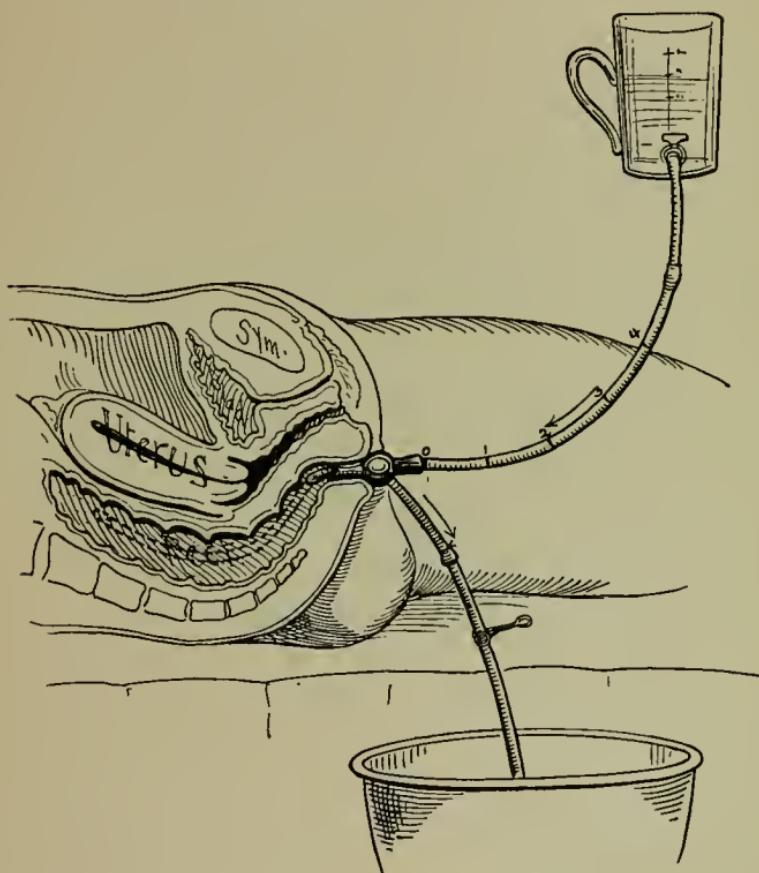


Fig. 140.—Double-current rectal irrigation apparatus used at Chatel-Guyon.

just proximal to the rectal tube, and remove after rectal tube has been introduced and securely strapped to the inner surface of the thigh by means of adhesive plaster."

Value of Murphy-Fowler Method.—This method of Murphy's in the Fowler position, or the Murphy-Fowler method, as it is called, is a distinct advance in therapeutics, and we are glad

to include it among hydrotherapeutic measures. Its use, along the lines laid down, has reduced the mortality of diffuse suppurative peritonitis from the high rate of 70 or 80 per cent. to less than 10 per cent. Murphy recently reported recovery in 51 cases, including 5 typhoid fever perforations, all severe. Stuart McGuire reports 18 cases with but 1 death, and other surgeons are no doubt having equally satisfactory results.¹

The semisitting position has some objections, which can be relieved by raising the head of the bed and keeping the patient on his right side. This position should be adopted at the outset.

In various places in France intestinal irrigation with natural mineral water is rather commonly used. This is done at Aix-les-Bains, but special attention is given to this form of treatment at Chatel-Guyon in Auvergne and at Plombières. We recently found in Paris an ingenious double-current rectal irrigation apparatus that is employed at Chatel-Guyon. The natural gaseous muriated water is introduced at low pressure at 100.4° to 118.4° F. (38°–48° C.) by means of the long rectal tube, which passes through a larger and much shorter tube inserted in the anus. A return flow is provided for as in Fig. 140. This apparatus is intended for either a high or low irrigation.

THE VAGINAL DOUCHE

To be effective this should be much more abundant than is usually given. To obtain the best results the ordinary fountain syringe does not suffice, because the quantity of water should be from 20 to 25 gallons, if possible, at a temperature of 113° F. (45° C.). Such douches form a feature of the method used at Luxeuil, France. Special apparatus providing for drainage by return current is, of course, necessary.

Position.—The technic calls for a special position—the knee-chest position—in which the hips are high and the body slightly lowered, so that the pelvic and abdominal organs are not only

¹ Surgery, Gynecology, and Obstetrics, June, 1908; Jour. Amer. Med. Assoc., March 8, 1908. See also Kothe on Continuous Irrigation of the Rectum by Salt Solution at 100° F., Therapie der Gegenwart, No. 10, 1907.

relieved of their own weight, but incline toward the diaphragm. The capacity of the vagina is increased, and the cervix uteri and vaginal walls are thus more effectively reached and influenced by the heat of the douche. All gynecologists seem to agree that full douches should do more than merely wash out the vagina.

These douches are indicated in uterine congestions; in the case of pain, hemorrhage, and dysmenorrhea occurring in nervous arthritic patients; in pelvic infections where, for special reasons, operations cannot be performed. In any case, there may be great palliation of symptoms, and douches of this magnitude regularly employed may limit or entirely remove the necessity for surgical interference. In the presence of exudates and tumefactions of the adnexa it would be prudent to give this method a thorough trial.

Pozzi states that in acute metritis vaginal douches of 113° to 122° F. (45°–50° C.), kept up for a long time, are of great service; also in chronic metritis, more or less pronounced, and in sensitive patients who complain of acute pain. They deplete the parts by stimulating the circulation, and are at the same time something of a local sedative. If properly used, they give relief in congestion of the vagina and uterus, and in cellulitis, when the inflammation is limited to the cellular tissue about the cervix uteri.

Dr. A. J. Skene gives credit to Dr. T. A. Emmet as being the first in the United States to popularize the method.

The French are using quite generally hot vaginal douches for pelvic infections and uterine congestion. While they do not cure a cervical metritis, they prepare the way for other treatment. But in an infection extending to the adnexa; in pelvic peritonitis; well localized salpingitis with slight swelling with enlarged and fixed uterus; or in diffuse lymphangitis without much swelling but causing adhesions, these douches are especially valuable. Richelot also describes¹ what is termed "arthritiques nerveuses," a class of non-infectious maladies variously described as uterine

¹ Bulletin de l'Académie de Medicine, November 17, 1908.

angiosclerosis, dystrophic troubles in young girls, with menorrhagia and leukorrhea and intermenstrual dysmenorrhea; and a class designated as "métérite douleureuse chronique."

Patients having these various affections have been very successfully treated in the excellent hydrotherapeutic establishment in Paris, conducted by Dr. Derecq, and recently visited by the author. We were especially impressed with the personal attention to details given by the director of this establishment.¹

PUBLIC BATHS

The Greeks and Romans established public baths on elaborate scales, and provided them with all sorts of attractions for the different grades of citizens. Mæcenas, the favorite of Augustus, introduced public baths in Rome, and this became an expression of popularity. Military heroes presented magnificent baths to the city, so that it is said that there were as many as 937 of these in Rome at one time. They were free to all classes. In the course of time the public baths were employed, not so much for hygiene as for dissipation and display. The fact that both sexes occasionally bathed together led to such irregularities that legal enactment forbade all women from such participation who did not belong to the class of *impudicæ mulières* (Garnett).

In the famous baths of Caracalla there were places for 1600 bathers, and in the Diocletian baths 3600 persons could bathe at the same time. During the reign of the Cæsars Rome possessed 11 large public baths and 926 smaller ones, in all accommodating 62,800 individuals. Rome certainly held the record for public bathing.

The baths of Pompeii were discovered in a complete state of preservation, the ornaments and inscriptions being found intact. There were several apartments which freely communicated with each other, and in which baths of different

¹ See also P. Dalché, *Traitement hydrotherapique dans les Maladies des femmes*, La Gynécologie, July, 1908. In Germany excellent reports have been made by Treub, Döderlein and Pfannenstiel.

temperatures were furnished. The section here presented, of a Pompeian bath-house, is taken from the work of Sir. W. Gell, and his explanations have been adopted, to a certain extent, in this sketch.

The *court* was a large room in which assembled all visitors, before taking the bath, and from it they passed to the various baths—some went to the frigidarium, where the cold bath was taken, or into the natatorium, for the purpose of swimming—

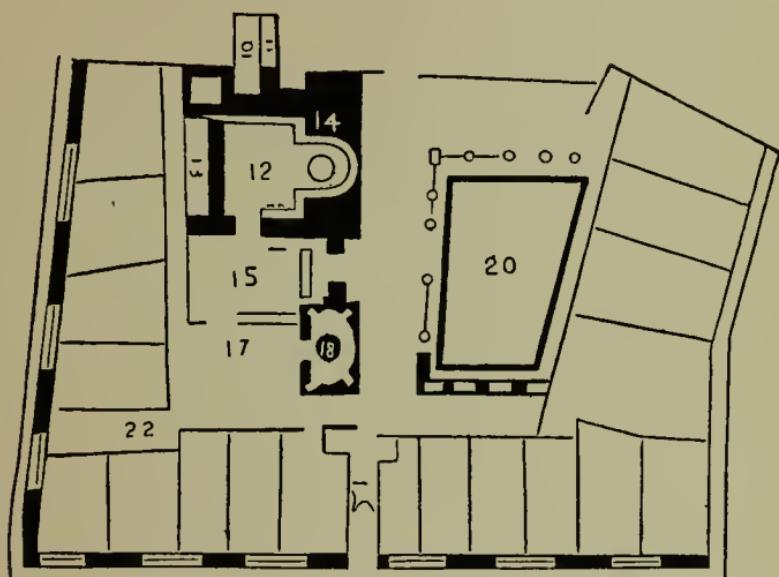


Fig. 141.—Section of Pompeian bath: 20, The court; 17, the frigidarium (old bath); 15, tepidarium.

the natatorium of the baths of Diocletian was 200 feet long, by 100 feet in width, giving ample space for this athletic exercise.

The *tepidarium* was a room filled with warm air of an agreeable temperature (110° to 115° F.— 43.3° — 46.1° C.), wherein the anointing of the person with rich unguents was performed. In this room were placed long seats, upon which the bathers sat. “The hearth (of the tepidarium) is about 7 feet long, and 2 feet 6 inches broad. It is of bronze, and is ornamented by thirteen battlemented summits and a lotus at the angles. Within these is an iron lining, calculated to resist

the heat of the embers, and the bottom is formed by bars of brass, on which are laid bricks supporting the pumice stones for the reception of the charcoal. This apartment was decorated in a manner suitable to its appearance. The pavement of white mosaic, with two small borders of black, the ceilings elegantly painted, the walls covered with crimson, and the cornice supported by statues, all assist in rendering this a beautiful and splendid place of relaxation for the inhabitants of Pompeii. The cornice begins at 4 feet 3 inches above the pavement, and is 1 foot $2\frac{1}{2}$ inches high, the abacus, which is $5\frac{1}{2}$ inches, included. Above this, the figures (Telamones) with the entablature rise to the height of 3 feet 5 inches more, and above there is the flowery Corinthian tracery. These figures are about 2 feet in height, stand upon little square plinths or dies, 3 inches high, and hold their arms in a posture fitted for assisting the head to bear the superimposed weight. They are of terracotta, and stand with their backs placed against square pilasters, projecting 1 foot from the wall, and with an interval of 1 foot $3\frac{1}{2}$ inches between each. The use of these figures in the baths of Pompeii, by whatever name they may have been called, was evidently to ornament the separations between the number of niches or recesses, in which the garments of those who went into the sudatorium, or inner apartment, to perspire, were laid up till their return."

The third apartment, No. 12, held the hot baths, and was called the *calidarium*. It had at one end, No. 13, a raised platform, upon which was placed a cistern of hot water, and was capable of accommodating 10 or 15 bathers at one time. At the other extremity was the *labrum*, from which flowed a constant stream of cold water, used for lessening the cerebral circulation when too highly stimulated by the hot bath. This compartment was heated with hot air and steam.

Excavation of Famous Baths in Greece.—It is announced from Greece that the buildings of the baths at Ædepsos, in Eubcea, have been discovered and excavated. The baths were very famous in antiquity; but no traces of the buildings could

be discovered, owing not only to the natural accumulations of soil above them, but to the incrusting action of the minerals in the springs. The discovery was accidental and the buildings were soon laid bare. The main building is round, with a waiting room decorated with pillars and statues. The second story evidently served as a reservoir for the water, with tubes to convey it to the room below. The absence of any sink or depression in the floor suggests that the baths must have been taken in portable wooden tubs. Another building evidently served for public baths, and was arranged accordingly, also decorated with statues. The Allg. med. Ct.-Ztg. states that the springs of Ædepsos have been flowing until recent times as in antiquity, but the local authorities recently tried to increase the flow with a dynamite charge, the result being the complete disappearance of the springs.

In England, Peter Chamberlen¹ was the first to advocate public baths.

SHOWER-BATHS

There are about 100 of these in thirty-four cities of the United States, and nearly all have been established since 1890. Floating baths had been established previously in New York, Brooklyn, and Boston, and Philadelphia and Chicago had pools, but all these were used only during the milder portion of the year. It was owing to the active influence of Dr. Simon Baruch, of New York, who made the first plea for rain or shower-baths in this country in 1889, that so much has been done to give the poor practical bathing facilities.

As chairman of the Committee of the County Medical Society of New York he recommended that public baths be located in the very center of the overcrowded districts. The buildings should be modest in style, so as not to repel the poor; they should be so constructed that a cleansing bath may be obtained without trouble and expense, or at a trifling expense, and without much loss of time. This idea that public baths should be cleansing

¹ Peter Chamberlen, *A Vindication of Public Artificial Baths and Bath Stories*, London, 1648.

always and free as public parks has been adopted by many municipalities in the United States. (See Government Report No. 54, Louisiana Exposition, 1904. Bulletin of the Bureau of Labor.)

Following the German plan, warm rain or shower-baths were substituted for the old-fashioned bath-tub. These are supplied from reservoirs of some height, affording considerable pressure. The outlay for tubs and their necessary care are avoided. The time for a shower-bath is far less, and there is much greater economy of space and in the quantity of water needed, requiring only one-tenth the amount of water. There is no danger in communicating disease. The refreshing effect of the shower, the temperature of which may be gradually reduced after cleansing, is valuable, and prevents danger from the relaxing effects of the warm tub-bath.

At the Volksbad, in Vienna, 70 persons can be accommodated at once, and for 5 kreutzer (2 cents) the bather receives a towel, an apron or mantle, a piece of soap, and a key to a closet where he places his clothing. He turns the water on, soaps himself thoroughly, and again opens the valve of the shower, which descends with so much force that it aids the bather in the cleansing process. In five minutes he finds himself more clean than he would become in a longer period in a tub-bath, the water of which must become soiled before its termination. The water is quickly drained away, and the apartment is soon ready for another occupant.

It was pointed out that a river-bath in summer is not to be compared in efficacy with the warm shower-bath in a well-lighted, well-ventilated, pleasantly warm room, with facilities for drying and dressing.

The New York Association for Improving the Conditions of the Poor established on these lines the "Peoples Bath" and other baths.

The floating baths of New York have a record of over 5,000,000 baths a year; and the municipal pool baths of Philadelphia nearly as many. When the present structures are completed,

10,000,000 baths will be available annually. The park department, under Commissioner Stover, is making active progress toward this most worthy end. In the slum districts of our largest cities few have private bathing-tub facilities. In such districts in New York City, 93.5 per cent. are without them; in Chicago, 96.2 per cent.; in Baltimore, 90.8 per cent., and in Philadelphia, 82 per cent. The need of greater bathing facilities is very great. In visiting 480 houses in the selected district in New York but 17 had bath-rooms; and in 378 houses in Philadelphia 67 had bath-rooms.

The author, with Dr. Baruch, visited the Riverside Association Bath in West 6th Street, New York City, and was most favorably impressed with the system of rain baths, hot-air baths, circular, jet, and Scotch douches, as afforded at nominal cost for the poorer classes.

The Philadelphia Public Baths Association conducts 3 bath-houses, and furnished over 100,000 baths in 1904, at a cost of 5 cents to each bather. In these, pool baths are employed. In addition, Philadelphia has 18 public bath-houses equipped with pools; they are open in summer from 6 A. M. to 9 P. M. In 1907 as many as 506,152 persons bathed in one week, and over 5,000,000 baths are given annually. They are open to men, women, boys, and girls. For 1906 the figures were 5,675,000; for 1907, 4,809,893. In Chicago there were 671,104 bathers in the public baths in 1906, and 577,684 in 1907. The comparatively cool summer of 1907 accounts for the reduction in the numbers.

SEA-BATHS

The important features of the sea-bath are the temperature, ranging from 55° to 75° or 80° F. (10°–23.9° or 26.7° C.); the force of the waves; the effect of the salt in solution, 1.6 per cent., on the skin, and the opportunity for exercise in the bath. These are elements of great power for good or evil, and very little consideration is given to them by the hundreds of thousands of bathers during the summer months.

Winter sea-bathing is popular on the Florida coast and at Coronado, California. The temperature of the water at Palm Beach averages 70° F. (21.1° C.) or higher in January and February, and 56° to 58° F. (13.3°–14.4° C.) at Coronado. At San Francisco it is about 52° F. (11.1° C.) the year round. The Gulf Stream emerges from the Gulf of Mexico in a narrow channel between Florida and Cuba, and follows the coast until it is about 65 miles distant from shore at Atlantic City. Its center is 135 miles from Atlantic City and about 185 miles distant from Sandy Hook. Its influence is not felt very much on the New England coast beyond Cape Cod.

At Virginia Beach bathing is good May 1st; on the New Jersey coast, as early as June 1st; on the New England coast beyond Boston, by the end of June. On the coast of Maine the temperature of the water varies from 55° to 67° F. (12.8°–19.4° C.), and the season is from July 1st to September 10th. At Cape May, New Jersey, the temperature of the water rises from 65° F. (18.3° C.), June 1st, to 80° F. (26.7° C.) in early September. On the Atlantic coast there are variations of temperature according to the wind—strong southerly winds raise the temperature, while “off shore” winds lower it.

At Atlantic City it is not unusual for 90,000 persons to enjoy sea-bathing in a single day. On Long Island Sound the temperatures are higher and the surf less than on the sea-coast proper. The advantages of these quieter waters for the young and the delicate are obvious.

Indications.—It is apparent that sea-bathing must be considered strictly in reference to local conditions before it is advised or condemned with regard to a particular case. It might agree with a person at Old Point Comfort or Cape May, and be totally unsuitable on the coast of Maine. The daily variation in the force of the waves and the presence of unusual currents are important factors.

For the strong and healthy individual the sea-bath is usually exhilarating and refreshing. The best time for bathing is in the forenoon, before the midday meal; not at the end of an exhaust-



Fig. 142.—The Beach at Atlantic City, U. S. A.

ing day of work; not before breakfast or at night; never directly after eating. These simple rules, however, are constantly violated by people who either cannot choose their bathing hour or indulge in two or three baths a day. The shorter the summer vacation the greater is the temptation to overindulgence. In their eagerness to make the best of their time, these persons lounge about the beach in salt-soaked bathing suits, cover themselves with sand, go in again and repeat the process, expecting to toughen themselves by the most unhygienic, foolhardy, and dangerous practices. The ordinary bath of ten or fifteen minutes is prolonged to hours.

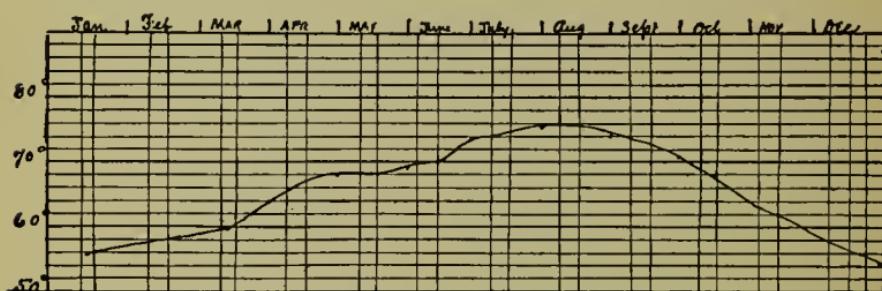


Fig. 143.—Temperature of the water at San Diego, California, 12 noon.

Sea-bathing is useful in anemia when not too prolonged; in torpor of the liver; in neurasthenia and hypochondria when not associated with too much debility; in nervous dyspepsia, chronic constipation, and obesity.

Reaction.—The principal safeguard in bathing is a good and prompt reaction. There should be a good glow, and it should be maintained by active exercise in the water. The body should be completely immersed; wading in shallow water and failure to wet the head and chest produce irregular circulation. Reaction is delayed in the weak and in elderly people, whose skin circulation is languid and whose heart action is poor; in those who are fatigued or overheated before bathing, and who are not accustomed to the low temperature of the ordinary sea-bath.

Precautions.—Those who are bathing for the first time in the season should be cautious and moderate until they are better accustomed to it, and inexperienced bathers had better avoid emulating the feats of the more venturesome. Muscular cramps are among the more formidable dangers to swimmers. They usually attack the leg muscles and sometimes the trunk, and quickly render the swimmer helpless. They are generally due to overstrain, and come on without warning during a long swim; they may occur in good swimmers. If the bather can be brought to shore he should be rubbed vigorously, dried, and warmed.

Colicky pains and abdominal spasms may follow a sea-bath taken too soon after eating. Two hours after a meal is a safe rule, but three hours is better if digestion be likely to be delayed. The effects of a sudden shock of cold water before digestion is accomplished are best met with heat externally, dry rubbing, and a small amount of tincture of ginger and water or a little whisky. ~

Aside from the danger of being carried beyond one's depth by unknown currents, or the common danger on some parts of the New Jersey coast of getting into channels of deep water on returning shoreward, a rather frequent source of trouble, there is the danger of remaining in the bath too long and of failing to react properly afterward. On entering the water there is a profound impression on the circulation. The temperature may be 30 or 40 degrees below that of the body, and the stimulus to the nerve-centers is great. The superficial vessels are immediately contracted, and the abstraction of heat from the extensive surface calls immediately for greater heat-production. The momentary shiver on entering the water should promptly give place to warmth and a sense of reaction.

Counterindications.—When the skin circulation is poor, as it commonly is in those inherently feeble or weak from illness, or in those of advanced years, sea-bathing should be avoided—at least, until better conditions obtain. In any case of heart disease, great care should be exercised; but, as is well

known, cold bathing, when properly used, tends to strengthen the dilated and weakened heart. Persons with cardiac lesions should have friends or attendants near and take no risks. No one should bathe in the ocean who has pulmonary disease or has recently had pneumonia, pleurisy, endocarditis, peritonitis, appendicitis, or acute Bright's disease. It is stated, on good authority, that sea-baths increase the elimination of urea. On that account we might suppose, *a priori*, that sea-bathing at moderate water temperatures would be beneficial in cases of moderate chronic nephritis. Care should be exercised, however, that the body should not be exposed to cutting winds. Women should not bathe during the menstrual period. Strange as it may seem, this rule is occasionally disregarded.

Complete immersion is a *sine qua non* of safety; it tends to equalize the circulation and hasten reaction. Women especially, dislike to wet their heads, as it takes so long to dry their hair; but with closely fitting, rubber bathing-caps, the hair may be kept dry and the head and neck are sufficiently cooled. Seabathing should not be indulged in when the body is greatly overheated; but a good warmth is to be desired, and no time lost, so as to get chilled by strong winds before going into the water. The chief safeguard in the water is to keep moving. A tennis-ball in the surf promotes activity and adds to the pleasure of the bath. Of course, no one should bathe shortly after a meal. Two hours should be allowed for digestion. One should not bathe when greatly fatigued. The bath in the quiet of one's house will be safer and more refreshing.

The writer takes about 75 ocean baths each summer, and has rarely seen ill effects in those who bathe regularly. Children who go in and out, sun themselves on the sands, and return again to the water, sometimes show bad effects; but most young people acquire a well-tanned skin in summer, and become so accustomed to sun and water that they seem to bear these transitions with wonderful ease. The author saw a case of appendicitis in a boy of ten, fever and pain developing on the evening of the day on which he had bathed in the surf. Forty hours

after the bath the operation disclosed free pus in the abdominal cavity. In this case, which fortunately terminated in recovery, no other exciting causes could be assigned, and it was believed that imprudent bathing had brought on the attack.

Duration.—No fixed rule can be made as to the proper duration of an ocean bath. This will vary from four to twenty minutes, according to the bather's age, physical condition, and the temperature of the water.

COURSES OF INSTRUCTION IN HYDROTHERAPY

Course at Columbia University.—This college has the honor of having established the first chair of hydrotherapy in an American medical college. This chair is ably filled by Dr. Simon Baruch, who has done more than any other American to bring this subject to the serious attention of the medical profession. Since 1907 the classes at Columbia have had the benefit of his teaching, although for several years Dr. Baruch has given instruction, with demonstrations, at the New York Postgraduate Medical School and Hospital.¹

The senior class is divided into sections of ten or more, who receive clinical instruction in the hydrotherapeutic department of the Vanderbilt Clinic on Mondays and Fridays. The first half of the clinic is devoted to demonstration of cases, the diagnosis is briefly dwelt upon, and the pathology and etiology are referred to with a view to point out the therapeutic indications. The aid of hydriatic measures and the reason for their employment, with or without drugs, in the concrete case are clearly gone into, and the patient is treated in the presence of the students, who are encouraged to ask explanations of any obscure point. The latter half of the clinic is devoted to demonstration of the technic of hydriatic procedures, and students are requested to practice them, just as they are taught bandaging or other manual procedures in other clinics. The clinic is under the charge of a chief and two assistants and an

¹ See introductory lecture to the course on Hydrotherapy in the College of Physicians and Surgeons, Columbia Univ. Med. Rec., Feb. 27, 1909.

attendant, who treat cases under their direction on Mondays, Wednesdays, and Fridays from 1 to 4 p. m. Only males are treated for obvious reasons. Female patients and cases not required for teaching are referred to the Riverside Association Hydriatic Department, which is under my direction, and treats about 50 cases daily. Wednesday afternoon is devoted to experiments in hydrotherapy. A course of lectures during the latter half of the semester is also provided upon the principles of hydrotherapy and their practical application in disease. The final examination contains not less than two questions on hydrotherapy.

The members of the class also have access to Dr. Wittson's wards in the J. Hood Wright Memorial Hospital, where hydrotherapy is practised in suitable cases.

Course at the Chicago Institute of Physiologic Therapeutics.—Dr. William S. Sadler's¹ plan of instruction in hydrotherapy provides for the following course:

Nerve training, or a graded system of thermic, electric, and hydriatic applications.

Muscle training, or graduated exercises, from the Sehott system to the heavy manual Swedish movements.

Cardiovascular training, beginning with the Nauheim régime and embracing graded hydriatic and massage measures, constituting a systematic course of vasmotor gymnastics.

Visceral training, consisting of special douches, massage, and phototherapy, for congested or anemic viscera.

Skin training, or a graduated system of hydrotherapy, for the debilitated and inactive skin.

Tonic régime for neurasthenia and other nervous disorders.

Courses in Europe.—In Würzburg, Prof. Geigel gives a course in balneotherapy.

In Jena, Prof. Kionka teaches balneotherapy during the summer session, and Prof. Matthes teaches hydrotherapy in

¹ Dr. Sadler also has a clinic for hydrotherapy, electricity, massage, phototherapy, etc., at the Post-Graduate Medical School, 2400 Dearborn Street, Chicago.

connection with clinical medicine. In Leipzig, Prof. Windscheid; in Halle, Profs. A. Schmidt and W. Winternitz.

In Berlin, Prof. Brieger is in charge of the new Institute for Hydrotherapy, which subject he teaches practically and ably, assisted by Drs. Krebs, Lacquer, and Machant. At present clinical lectures are delivered with demonstrations on four days each week, 11 to 12 a. m. Prof. Frankenhauser gives instruction in balneotherapy. Prof. Curschman, in Leipzig, has an institute for physical therapeutics; there is also an excellent hydrotherapeutic institute, in Rome, on the via Plinio. Prof. Lechtheim teaches hydrotherapy at Konigsberg; Prof. Schulz, at Greifswald; Prof. Ereklenz, at Breslau.

A remarkable improvement in hydrotherapeutic facilities has been recently noted throughout Europe, and crude apparatus is being rapidly supplanted by the best to be found anywhere.

Dr. J. H. Pratt, of Boston, was much impressed with this fact, and states that it is less than ten years ago that Munich had the only well-equipped department of physical therapeutics in Germany, and before it was opened Dr. Baruch did not find a single clinic in that country with a good hydrotherapeutic douche table. Now all this is changed. In the small city of Heidelberg, for example, there is an institute for physical therapy connected with the university polyclinic, which, in the character and excellence of its equipment, is unequalled by any in the United States. What is of equal importance is the careful medical supervision of treatment. This is under the direction of Prof. Hammer, who is assisted by 8 trained operators and masseurs. This institute for physical therapy occupies over half of the new building of the medical polyclinic, which was erected in 1906 at a cost of \$40,000. The growth of scientific hydrotherapy has created a demand for better apparatus. As a result, the best hydrotherapeutic appliances, including the best douche tables obtainable to-day, are made in Germany, although, as stated above, it is only a few years ago that Dr. Baruch called attention to the lack of proper hydrotherapeutic facilities throughout that country.

In the medical clinic of Prof. Krehl in Heidelberg there is another complete hydrotherapeutic equipment for the treatment of in-patients. A department for mechanotherapy is maintained by Prof. Vulpius in connection with the orthopedic clinic. In addition there is a large and attractive "Halle-Bad," which is owned by the City of Heidelberg. The new and expensive buildings contain not only shower and swimming baths, but are equipped also with apparatus for electric-light and carbon-dioxide baths.

In Tübingen a douche apparatus has been recently installed.¹

ACCIDENTS IN HYDROTHERAPY

The chief dangers are from falls upon slippery places in the bath-room or douche-room; from vertigo or faintness in getting in or out of the tub, and from epileptic or other convulsions. The author has a remarkable collection of such accounts, taken from the public press. Baths given for medical purposes need much more supervision than baths for ordinary purposes, as the person bathing may be weaker or have some cardiac or cerebral trouble which the heated air of the bath-room or the confinement and heat of the pack accentuate. Recently the public press reported the death by drowning in his own bath-tub of a man whose head had slipped below the water in a faint. Hence, an attendant should be at hand, and the patient should never be left unguarded.

Drowning accidents due to epilepsy have happened in tubs and swimming pools. Patients have been burned or scalded by hot applications made while unconscious (see p. 181).

Claims for damages are occasionally demanded by patients, so that a recent case in Paris has excited a good deal of attention. A medical man, Dr. Cormon, had been called in to attend a young woman, Mlle. Peyronnette, suffering from appendicitis, and as the result of his treatment by ice-bags an eschar had formed, and 50,000 francs damages were claimed. Dr. Balthazard, the medical expert, who had been chosen by the

¹ International Clinics, eighteenth series, vol. iv, 1908.

court to give his opinion, had been rather severe in his first report, but when the trial came on he was much less so, and he found arrayed against him the whole faculty, who one and all considered the eschar an accident which in nowise could be foreseen. Dr. Cormon had been accused of not using a piece of flannel cloth as a protection, but he argued it was the practice of many surgeons to apply the ice-bag directly on the skin. The prosecution found that it could not attack Dr. Cormon on this count, so it accused him of having failed to see the symptoms indicating the advent of an eschar. Dr. Cormon answered that he had foreseen them, and had then had the ice removed. Dr. Jalagnia and Prof. Dieulafoy declared that there was no exact limit as to the amount of time during which ice should be used on the abdomen, and as for the eschar, it sometimes appears with the greatest rapidity. The testimony showed that Dr. Cormon had not taken the temperature of the patient, which was another fault of which he was accused. Dr. Triboulet, who succeeded to Dr. Cormon in the treatment of the patient, said he had very few changes to make in what was done. Judgment was given as usual a week after the calling of the witnesses, and Dr. Cormon was acquitted.¹

Paralytics have been scalded to death by careless attendants. In a recent case the nurse turned on the hot and cold water together while a paralytic was bathing. While the nurse was absent the hot water caused fatal injuries.

¹ Therapeutic Gazette, 1907, p. 747.

CROUNOTHERAPY¹; CRENOLOGY²; OR THE USE OF MINERAL WATERS INTERNALLY

THE vast extent to which mineral waters are used internally is remarkable. In the United States over 56,000,000 gallons of natural American mineral waters, from 600 springs, are sold annually at a valuation of about \$7,300,000. The importations of natural mineral waters reach about 3,000,000 gallons, and are valued at \$1,033,000.³ To what extent waters are sold and consumed in Great Britain and the continent of Europe is unknown, but it is known that 30,000 visitors visited Carlsbad in 1906, of whom 2000 were Americans. The number of annual visitors at Nauheim is also about 30,000. At Baden-Baden they number over 100,000 annually. Of course they drank the waters as well as bathed in them.⁴

In the United States there are about 2800 spring localities and nearly 9000 individual springs. In the Yellowstone Park there are 2000 springs and 100 geysers. With this wealth of mineral water in the United States, we naturally wish to make an approximate comparison of our own springs with those of Europe. From an analytic standpoint this may be attempted, but in point of equipment, régime, and scientific application of the waters, America is far behind the European system, although fair attempts are made in a few American resorts to

¹ Term suggested by David Riesman, Cohen's System of Physiologic Therapeutics, vol. ix.

² Term suggested by Leonard Williams, The Clinical Journal, London, February 3, 1904.

³ See The Production of Mineral Waters in 1908, by Samuel Sanford, Washington, D. C., Government Printing Office, 1909. Dept. of the Interior, U. S. Geological Survey.

⁴ It has been calculated that upward of 200,000,000 gallons of aërated waters are consumed in Great Britain and Ireland per annum (Hutchinson). These waters were invented by the distinguished chemist, Joseph Priestley, in the latter half of the eighteenth century.

carry on the principles of hydrotherapy successfully. In Europe the springs are generally owned and controlled by the local or national governments, which have spent large sums in permanent improvements, including imposing buildings, adequate apparatus, and all the accessories that make the visitor's stay agreeable as well as beneficial. There are strict regulations and usually a small tax is imposed, according to the length of stay, the proceeds being applied toward permanent improvements.

In America there is no State regulation, excepting at the 900-acre reservation at Hot Springs, Arkansas, and in the Yellowstone National Park, where the United States Government owns the ground and exercises strict control over the use of the water and fixes the schedule of charges. Private corporations control the best resorts in this country, and, as a rule, they are alive to their own interests and jealous of the reputation of their particular springs. But the chief criticism under this arrangement will always be that "to him that hath shall be given," but to him that hath not little attention is paid. The expense of hydrotherapy is very great, although more is being done for the poor of our cities than formerly. It is to be hoped that, as the wisdom and the feasibility of giving the fresh open-air treatment to the poor consumptives is being learned, the state or national government will eventually take up the corresponding charity of giving to the poor rheumatic, or otherwise disabled citizen, the benefits of our hot springs or other waters so liberally provided by nature.

The United States Government has equipped hospitals at Hot Springs, Arkansas, for the officers and enlisted men in both branches of its military and naval service, and also a free government bath-house for indigent sufferers. The Yellowstone National Park awaits development in this respect, and for a portion of the year could no doubt be utilized. The State of New York has recently appropriated one million dollars toward acquiring the famous springs of Saratoga, so that the famous resort, with its valuable springs, may be developed and maintained as a State property, free from objectionable features, and available for the people of every class.

CLASSIFICATION OF MINERAL WATERS

The following classification by Dr. A. C. Peale; of Washington, is the most practical.¹ It gives at once a definite idea of the general chemical composition and other characteristics:

Group.	Class.
A. Thermal.....	I. Alkaline.
	II. Alkaline-saline.
	III. Saline.....
B. Non-thermal....	IV. Acid.....
	1. Sodic
	2. Lithic
	3. Potassic
	4. Calcic
	5. Magnesic
	6. Chalybeate
	7. Aluminous

Sulphated,
 Muriated,
 Borated.
 Sulphated,
 Muriated,
 Borated.
 Sulphated,
 Muriated,
 Silicious..... { Sulphated,
 Muriated.

Non-gaseous.
 Carbonated CO₂.
 Sulphurated H₂S.
 Azotized N.
 Carburated.
 Oxygenated O.

RADIO-ACTIVITY OF MINERAL WATERS

Waters containing a comparatively small amount of mineral constituents have been claimed to have a therapeutic value which the ordinary chemic analysis fails, as a rule, to explain in any adequate manner. It is barely possible that the recent discovery of radio-active properties in some of these waters may afford some explanation of these qualities. Some of the thermal springs of Europe, such as Baden near Vienna, Bad Gastein, Joachimstal near Prague, Luchon, Plombières, Dax, La Bourboule, Aix-les-Bains, and Buxton, England, have been

¹ See Transactions of the American Climatological Association, 1887, p. 156.

tested in this respect, and have been found to contain slightly varying quantities of argon and helium with distinct radioactive properties, these elements showing a constant association with waters of this class. The suggestion has been offered that this fact throws some light on one of the problems of the chemistry of mineral waters, namely, why a natural mineral water should have distinctly greater therapeutic power than a water to which is given artificially precisely similar chemic constituents according to a standard analysis.

Mineral-water baths afford a great opportunity for charlatany. Claims are made regarding an electric action in the bath, and the mysterious quality of radio-activity has lately been brought forward, reaching England and America, in explaining the efficacy of various mineral springs. W. R. Huggard says, "There is not a particle of scientific evidence to warrant the belief in any greater electric action in the mineral baths at spas than in baths taken quietly in one's own room. The radio-activity of mineral waters now occupies much attention, but, up to the present, we have only speculations as to its therapeutic influence."¹

¹ The following letter, from Prof. Wolcott, was received by the author in response to an inquiry as to the radio-activity of waters in Colorado:

Colorado School of Mines, Golden, Colo., Jan. 3, 1906.

Dear Sir:

In regard to the mineral waters of Colorado, I have examined the waters at Glenwood Springs and at Manitou and found them radio-active. I have examined also several samples sent in, but found none of them radio-active. The water from Clear Creek, which flows through this city and which drains the region near Central City where the Pitchblende mine is located, is radioactive and the time of decay corresponds to that of the radium emanation. We are at present working along this line and the results have not as yet been published.

Very truly yours,

E. R. WOLCOTT.

Prof. Boltwood, of Yale, was commissioned by the U. S. Government to examine the waters of Hot Springs, Arkansas, and reported them all radioactive. This is due to a dissolved radium emanation, a gas, and not the presence of salts of radium or other radio-active substances.

"Another antiquated notion is that the solid constituents of the baths are absorbed through the skin. The evidence is now overwhelming that through the unbroken skin there is no absorption except for gases, volatile substances, and substances incorporated with some fatty agent which can be rubbed in. Iron, even if present in tenfold the amount found in mineral waters, would, when applied externally, be quite incapable of acting on the blood."¹

The following is a partial statement of the radio-activity of various European springs, according to the authors quoted:

	Radio-activity in milligram minutes (10 liters of gas).
Bad Gastein, Austria, Gratenbacker.....	79.20
Bagnères-de-Luchon, France, Borden.....	18.36
" " " Source, Borden, No. 2.....	14.43
" " " " Pre, No. 1.....	10.23
" " " " Saule, No. 2.....	9.42
" " " " Ferras enceinte.....	4.19
Plombières, Source, Vauquelin.....	14.90
" Galerie de Thalweg.....	13.60
" Les Capucins.....	4.62
Aix-les-Bains, France.....	3.52
Dax, France, Source, Trou-des-Pauvres.....	2.92
Bagnères-de-Bigorre, France, Source, Salies.....	2.32
La Bourboules, France (Waters).....	3.56
Bagnères-de-Luchon ".....	2.20
Aix-les-Bains ".....	.54

Mm. Curie and Laborde, Mm. Ch. Moureu, and A. Lepape and A. Brochet have made a systematic study of the radio-activity of some French springs. The observations are reduced to a standard of "milligram-minutes" for 10 liters of gas emanating from the spring tested, and also for 10 liters of the water. The standards of measurement were first prepared by Mm. Cheneveau and Laborde,² and are detailed by Mm. Ch. Mouren and Adolphe Lepape in *Bulletin de l'Académie de Médecine*, 1909, No. 13.

Mouren and Lepape spent six months at Bagnères-de-Luchon

¹ Handbook of Climatic Treatment, London, 1906.

² Journal de Physique, 1908, 3d fascicule, p. 262. For the radio-activity of the waters of Baden-Baden, see The Brit. Med. Jour., April 23, 1910, p. 1004.

with Mm. les Drs. Ferras and Estradere in the study of twenty separate springs. They noted that the emanation of radium from the gas which they tested diminished gradually and spontaneously after collection, so that after about four days only about one-half of the radio-activity remained, corresponding in this respect with M. and Mme. Curie's statement.

The Joachimsthal Baths.—Ever since the examinations, conducted by competent scientists, of the nature of the therapeutic action exercised by the Gastein waters have shown that the main source of the beneficent quality is the presence of radium emanation, experiments have been going on in the place where the greatest quantities of pitchblend and radium salts are found, in Joachimsthal near Prague, to ascertain whether the waters found in these mines could not be used for medical purposes. At the clinic of Prof Neusser of Vienna, a large number of patients have been subjected to a treatment with these waters. Patients with gout, rheumatism, neuritis, and diabetes have been benefited by the internal and external use of Joachimsthal mine water. It has been found that there are two distinct groups of waters to be obtained therefrom. The weaker water, containing from 8000 to 10,000 volts of emanation, was derived from the underground springs and brooks, which are constantly flowing in the deeper shafts, and have to be pumped away to keep the mine workable. The stronger water was obtained from the refuse of the mining process, which combines various chemic processes, and in its last step requires the washing of the material by sulphuric acid. The ultimate results are uranium (used for coloring purposes) and a water charged with radium emanation in a high degree, so that it excels the Gastein waters three or four times in its voltage. These latter waters have been used also for prostatic enlargement with remarkable success. The baths have shown themselves so active that general symptoms (due to destruction of leukocytes) may appear after incautious use. In Joachimsthal itself, a bathing house with at present only twelve cabins has been established for radium baths. In a similar way the hot sulphur baths of Baden, near Vienna, have been tested

and the presence of radium emanation, though in a lower degree, was detected. The experiments tend to show that the presence of the active principle is in an inverse ratio to the temperature of the water. The sulphur mud deposited at the hot springs in this place contains radium bromid, so that it affects the photographic plate. This explains why, for instance, inveterate cases of skin disease respond so readily to the mud baths at Baden, although they are refractory to water baths and ointment even in Aachen or other hot sulphur baths. It is planned now to institute special radio-active sulphur baths in this place, and it will be the first health resort of its kind which can boast both of the vicinity of the capital and of the radio-activity.

Artificial Radio-active Waters.—Attempts have been made to produce radio-active water by artificial methods for therapeutic purposes. Dr. William J. Morton uses a water rendered radio-active by immersing from 50 to 100 pounds of a high-grade pitchblend in a vessel of water, and has found that the measure of radio-activity of the water is about one-tenth to one-half that of metallic uranium. The rate of decay of the radio-activity, however, was very rapid, falling to one-half in a few hours, and no trace remaining after a few days.

Dr. John B. Shober, of Philadelphia, following a suggestion of Prof. E. Rutherford, of London, has used purified cocoanut charcoal, and succeeded in raising the water so treated to one hundred and sixty times the radio-activity of uranium oxid. His conclusions are that the beneficial effects of radio-active spring waters, and the results obtained abroad by the administration of weak emanation preparations, warrant the belief that in the highly radio-active charcoal we have an agent that will be followed by the same, if not better, results.¹

The waters of Kreuznach have been used extensively for a long time for bathing, and of late a good deal of stress has been laid on the radio-activity of these waters as a factor in the cure. Englemann attributes great value to the well-known

¹ Jour. Amer. Med. Assoc., Aug. 21, 1909, pp. 624-628; see also Nagelschmidt, Berliner Klin. Woch., March 16, 1908.

rich radium emanations of the water and the sediment. He has recently¹ reported on the results obtained in 234 patients, who took 2595 baths, the principal indications being rheumatism, sciatica and other neuralgias, gout, and for the resorption of pelvic exudates. The results were considered favorable.

Other springs, as those of Pöstyén (Pistyan), in Austria, are also coming into favor in the same manner, having a fair degree of radio-activity.

INTERNAL USE OF WATER IN HEALTH

The healthy adult requires, according to his weight, from 1 to 2 quarts of water daily, independent of the water contained in food. The labor of transferring this amount to the excretory organs—the kidneys, lungs, bowels, and skin—falls on the heart. The circulation, glandular secretions, peristalsis, and metabolism are distinctly influenced. Water is not absorbed to any very great extent by the stomach, but by the bowels, and hence as much good or more can be accomplished by eneteroclysis as by administration of water by the mouth.

Regarding metabolic changes produced by water drinking, it must be recognized that for a short time, at least, nitrogenous products are washed out, but it has been shown that pure water has no effect on the splitting up of albumins and on the general metabolism (Rubner).

Schoendorff and other authorities believe that water drinking has very little practical effect on the excretion of uric acid.

HOT-WATER DRAUGHTS

Hot-water drinking is not so much in vogue as it was ten or fifteen years ago, probably on account of the tendency to undue relaxation of the gastro-intestinal tract when continued for long periods. In small quantities hot water raises the pulse-rate and lowers the blood-pressure. After twenty minutes the usual rate and pressure are restored.

¹ Medizinische Klinik, May 30, 1909, No. 22.

Natural Thermal Waters.—The principles applying to the use of hot- or warm-water draughts are equally applicable to the weaker natural thermal waters. These are indicated in hyperchlorhydria, gastrorrhœa, and gastralgia; acute, suppurative, and interstitial nephritis. In the latter affection there are favorable reports from the judicious use of water, in connection with hot applications to the back and abdomen. The author is more inclined to the moderate use of water in nephritis than in his earlier practice.

Hot-water draughts are counterindicated in disease of the heart with failure of compensation. In this class of cases it is best to restrict the total quantity of water consumed to about 1200 cc., independent of the water contained in the food. In administering water to promote diuresis, it must always be borne in mind that we have to look to the heart for the *vis a tergo*: while there is low pressure in the kidneys there can never be satisfactory diuresis.

The weaker natural waters are usually more acceptable to the stomach by reason of large gaseous contents at their source. Artificial heat applied to ordinary tap-water drives off the carbonic acid gas and oxygen, which are largely present in most thermal springs.

Hot springs are found in Virginia, Arkansas, California, Colorado, New Mexico, and South Dakota. In Europe, those of Aix-la-Chapelle, Baden-Baden, Ems, Carlsbad, Wiesbaden, Gastein, Bath, and Aix-les-Bains are the most famous.

COLD-WATER DRAUGHTS

These are indicated in febrile states and in hypochlorhydria. The most favorable time for use is thirty to forty minutes before meals. Cool water should be used freely before and during the hot bath, and given abundantly in typhoid fever. In some hospitals a special nurse is assigned to give water to the patients.

Cold water is counterindicated in gastric dilatation, gastrophtosis, colic, in cases with a weak myocardium, and in all states of fatigue and when perspiration is free. Ice-water is

particularly dangerous at these times, although the temptation is very great to quench thirst. In most cases the free use of water during meals is not advisable. It is believed to delay the digestion of starchy and other foods. Individuals, however, vary greatly in this respect, and many are accustomed to drink 3 or 4 glasses of water during meals with entire impunity. The author believes that a moderate amount of cool water—1 glassful—is not, as a rule, injurious. Patients who must avoid starchy foods, and who eat freely of meat, are no doubt benefited by the free use of pure water before and after meals. Most people drink too little, and this is particularly the case with women, and very often leads to constipation, acid, dense urine, and occasionally to irritability of the bladder accompanying urine of high specific gravity. Many stomachs are ruined by an attempt to flush the system with large quantities of water, and hence it is a rule to avoid large quantities of water or liquid food in cases of gastrophtosis, etc. (see p. 150 *et seq.*).

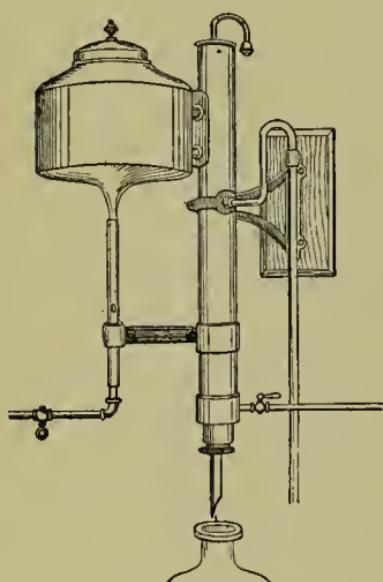
DISTILLED WATER

This is a chemically pure water, made palatable by the addition of oxygen, with or without carbonic acid gas. Much discussion has arisen as to the propriety of using a water without any solid constituents, the claim having been made that its use tends to abstract valuable salts from the system. These objections are more theoretic than practical, the rather extensive use of distilled water on shipboard and elsewhere not having been attended by any bad results. Oxygenated and carbonated distilled water is widely sold under various trade names in siphons. It is much more palatable than the distilled water of the chemic laboratory and more economical.

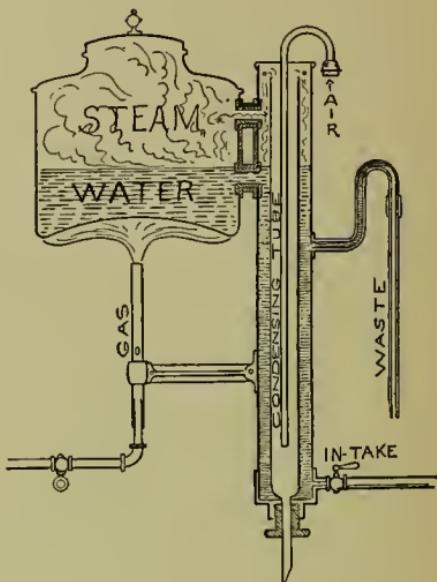
Distilled water can be easily and cheaply produced for household use by means of a still heated by gas or oil. A satisfactory apparatus, shown in Fig. 144, is known as the Parmelee Automatic Aërating Water Still and Sterilizer. If oil be used to heat it, a blue-flame Primus or Khotal oil-stove should be employed.

Distilled water is no doubt an ideal drinking-water, far preferable to the mineralized waters for constant use. In regions where limestone formations and alkaline deposits characterize the soil, the use of distilled water would prevent the disturbance of the stomach and bowels commonly observed.¹

Dr. G. Bullot, of the University of California, has recently carried on some experiments with fresh-water crustaceans, finding that they die promptly when placed in distilled water.



External view.



Sectional view.

Fig. 144.—The Parmelee still (Ashton).

It is the author's belief, however, that oxygenated distilled water for drinking purposes is not injurious.

Marcuse noted the total amount of urine voided by a patient aged thirty-five who, for five years, had had chronic parenchymatous nephritis. This patient for ten days previous to the experiment passed an average of 724.5 cc. of urine, the specific

¹ See article by Marcuse on Advantages of Distilled Water as a Beverage in Nephritis, *Berliner Klinische Wochenschrift*, xliv, No. 14, 1907. See p. 405; Winckler, *Zeitschr. f. diet. u. physik. Therap.*, Bd. viii, H. 10, p. 567.

gravity varying from 1.019 to 1.025; the albumin ranging from 1.35 to 2.25 per cent. by Esbach's scale. During the subsequent ten days, in which from 1 to 1½ liters of distilled water were given daily, the average amount of urine was 1326 cc.—an increase of 83 per cent. The specific gravity was gradually lowered to 1.007, and the amount of albumin excreted remained about the same. The increased diuresis was not accompanied by an increase in the amount of solid constituents in the urine, but rather the reverse. Under the use of Pyrmont water, however, during the next twenty days the total amount of urine slightly increased to 1610 cc., and the amount of albumin passed was slightly greater. Marcuse's conclusions are that distilled water has not the slightest injurious effect on the organism. This conclusion was borne out by further studies by Axel Winckler, Marcuse, and others.

The purer the water the greater is the capacity for the solution and the elimination of the unnecessary salts produced in the process of digestion and assimilation. The food should provide all the necessary salts in abundance, and hence distilled water, or the chemically indifferent waters, are best for constant use. The author does not wish to be construed as depreciating the value of the more highly mineralized waters. They are undoubtedly valuable for purgative and other purposes and favor elimination through the bowels. They have their place for occasional use. Other individuals seem to require the constant use of an alkaline water, but the average man is better off on the purest water he can find.

American waters containing a minimum of salts are the following: Maine—Poland Springs, Highland Springs, Mount Hartford Spring; Vermont—Equinox Spring; Massachusetts—Commonwealth Mineral Spring, Massasoit Spring, Nobscot Mountain Spring; Connecticut—Stark Mineral Spring; New York—Colonial Springs, L. I., Great Bear Water, Sun Ray Water, Ellenville, N. Y.; Pennsylvania—Glen Summit Water, Roscommon Spring; Maryland—Bentley Spring.

WATER DRINKING IN DISEASE

Obesity.—Authorities differ greatly regarding the use of water in this condition. Mr. Banting, who reduced himself in a year from 202 to 156 pounds, limited the total daily amount of fluid to 35 ounces. Oertel allows 8 to 16 ounces of water, 12 ounces of wine, and 2 cups of coffee, tea, or milk daily. In hot weather the amount of fluid may be slightly increased, and should be taken in small portions through the day. Schweninger suppresses all beverages at meals, and allows no fluid until two hours have elapsed since food. Germain See, on the other hand, allows large quantities of warm aromatic drinks. No doubt this is the best course in fat and gouty people, and such patients may be allowed $\frac{1}{2}$ pint of water after each meal and at bedtime. Where physical exercise is required, and especially when depleting baths are used, water should be allowed. Even during meals some water should be taken to aid in the solution and digestion of food. (See p. 197.)

In treating **poorly nourished persons**, water may be added to milk in the proportion of 2 tablespoonfuls of hot water to a glass of milk, to which is added 5 gr. each of common salt and sodium bicarbonate. In this way the digestibility of the milk is favored.

Bronchitis.—In all cases of bronchitis with hard and ineffect-ive cough, water generally gives relief. Warm drinks before retiring will frequently allay cough, and, as every mother knows, a drink of water will often stop a persistent cough in children after settling for the night.

Measles and Bronchopneumonia.—Cold water in quantities from 4 to 6 ounces should be given to children with measles and bronchopneumonia, and repeated every two or three hours.

In **nephritis** it is generally held that the free use of water internally is beneficial. Certainly a glassful, taken night and morning on an empty stomach, will act as an eliminant. It does not follow, however, that where much is good more is better. It is quite possible to flood the heart and arteries with water and

seriously overtax them. Ascites is a very evident counterindication. The underlying motive in giving water and milk extensively is to flush the kidneys and aid the elimination of toxins or other irritants.

Prof. von Noorden, however, in his monograph on Nephritis, takes the ground that, as water is always very badly excreted by the kidneys when they are acutely diseased, and frequently also in subacute and subchronic forms of nephritis, the extensive use of milk and water is not logical: "A condition of hydremia must be regarded as a constant source of irritation of the kidneys, and the problem that confronts us is to prevent excessive stimulation of these organs as much as possible."¹

Concentration of Blood-serum after Taking Much Water.—Engel and Scharl were unable to discover that the blood-serum became less concentrated after ingestion of large amounts of water followed by copious voiding of urine. No hydremia to speak of is observed under such conditions, either in the healthy or in those with kidney affections. On the contrary, an actual increase in the concentration of the blood-serum may be noticed, sometimes at the time of the greatest diuresis.

It has been frequently noted that water from glacier ice has an injurious effect on the gastric mucous membrane, independent of its low temperature.

Some difference might be expected according to whether hypotonic water or hyperisotonic water were used. Grube used the former and found a very slight increase, but Grossmann,² with waters of both these classes, found no essential alteration in his own person. In cases of disease, however, the result might be different.

Unless the heart be seriously at fault, the author believes in giving water moderately in nephritis; especially pure or the slightly mineralized waters, skimmed milk, ginger ale, etc. People vary, but water drinking is certainly in most cases a physiologic, hygienic, and remedial measure of value.

¹ Berliner Klinische Wochenschrift, xliv, No. 14.

² Grossmann, Deutsche Med. Woch., 1903, 276.

A draught of cold water may reduce the frequency of the pulse and cause a slight fall in the body temperature, especially in the internal temperature as measured in the rectum (Weber).

In **typhoid fever** cool water should be administered in small quantities at frequent and definite intervals. It may be possible in this way to give as much as 2 or 3 quarts in twenty-four hours. The amount of urine is increased, the nervous symptoms are lessened, and the patients are made more comfortable. The internal use of cold water is a good adjuvant to the cold bath and it is believed to lessen the mortality.

The method adopted by E. F. Cushing and T. W. Clarke in 100 cases treated by this method was to give not less than 3 pints daily. It was found that the amount of water that patients would take could be greatly increased. The quantity often reached 1 or $1\frac{1}{2}$ gallons. This was accomplished by giving 4 ounces of water every fifteen minutes during the waking hours. In addition, the patient received alternately, 6 ounces of milk and 6 ounces of albumen-water every two hours during the day and once or twice at night, representing some 3 pints of fluid. Besides all this, a bowl of ice-water was kept by the bedside, so that the patient could help himself. An occasional patient rebelled at first, but the majority took the water readily and some greedily. The natural result was first a great increase in urine, which rose as high as 8 to 12 pints, and was maintained at this standard during the febrile part of the disease. Fewer baths were required and headaches were not so troublesome, the mouth was noticeably clean and moist, and the nervous and toxemic symptoms less. There were few complications, and the mortality as well as the severity of typhoid fever seems to be lessened by this free use of water internally. We have not noted, however, any great tendency to adopt these suggestions. It is possible that the method is open to objections.

Heart Disease.—In general, it may be said that mineral waters containing lime salts should be avoided by patients with heart disease. Lime is believed to raise the blood-pressure, and an excess of fluid has obvious disadvantages. Those with mitral

lesions should reduce the intake of fluid to about 2 pints a day.

In valvular heart disease, especially in imperfectly compensated mitral disease, in obese people with weakly acting hearts, and in patients suffering from atony of the stomach with dilatation, water should be restricted. People who work hard in a hot atmosphere are liable to habitually drink a large quantity of water or beer, and suffer from digestive disturbances due to a weakening of the gastric juice. Bakers and men in breweries may have what is known as a chronic hydremic plethora, which favors dropsy and degenerative changes in the heart and blood-vessels.¹

SPECIFIC VALUE OF MINERAL WATER

ALKALINE WATERS

These are sodic or sodic-magnesic or alkaline chalybeate or calcic. The best waters of the first group are Saratoga Vichy, Ukiah Vichy, Cal.; St. Louis Spring, Mich.; Manitou, Colo.; and California Seltzer. They are rather more potent than the corresponding foreign waters.

The principal European waters of this class are those of Vals, in the Ardèche, France; at Karlsbad, Austria; Vichy, in France; in the Auvergne Mountains, Bilin and Marienbad, in Bohemia; Fachingen, Wildungen, Ems, and Apollinaris in Germany. Apollinaris is found the world over, and as a table water is *par excellence*. The Vichy Celestin, or Grand Grille, is also widely sold in America. This water is of great value to dyspeptics with strongly acid urine, to gouty and rheumatic subjects, to patients with biliary calculi, and to patients having eczema or psoriasis associated with markedly acid tendencies. A tumblerful may be taken two or three times a day, but not continued, as a rule, more than two or three months at a time.

The author has never seen any bad results from taking

¹ See Climatotherapy and Balneotherapy, by Sir Hermann Weber and F. Parkes Weber, London, 1907, p. 301.

Celestin Vichy for long periods, notwithstanding very extensive use of this water. He is personally acquainted with a gentleman who has had attacks of gall-stones, and has used the water almost daily with benefit during a period of over two years.

Waters of the Carlsbad type, hot sodic-magnesic alkaline waters, are especially valuable in hyperchlorhydria and ulcer of the stomach. Exceptional cases arise, but in general it may be said that Carlsbad is especially useful in completing the cure of gastric ulcer. Chronic catarrhal conditions of the gastro-intestinal tract do best at Carlsbad. Patients with constipation and hemorrhoids are more successfully treated with the colder waters of Kissingen.

Fachingen water has a great reputation in Germany, owing partly to the fact that the emperor is reported to take it daily. It has been subjected to elaborate tests by Klemperer,¹ who demonstrated that the weak alkaline urine produced by Fachingen water can actually dissolve concretions of uric acid; 100 cc. of a twenty-four-hour specimen of a patient's urine were taken in three days, and a uric-acid stone was immersed for twenty-four hours in each specimen. In the faintly alkaline urine there was a slight loss; in acid urine, on the other hand, there was an infinitesimal gain. By drinking a bottle of Fachingen water daily the free uric acid fell practically to *nil* (von Noorden).

Observations such as those on calculi already excreted are no doubt encouraging, but the important matter to determine is the value of these alkaline waters in controlling the excretion of uric acid in true uric-acid gout. There is a great deal of misconception as to the value of mineral waters in this respect. Patients are invariably disappointed if larger quantities of uric acid are excreted after the ingestion of such waters; and however encouraging to the physician such a temporary circumstance may be, the patient always wants to know that the output is reduced.

In gout, according to von Noorden, with or without uratic

¹ Behandlung der Neirensteinkrankheit, Therapie der Gegenwart, 1904, 337.

deposits, the normal average excretion of uric acid and purin bases is, as a rule, not quite attained, and, in spite of our ignorance of the pathology of gout, increased uric-acid excretion must be regarded as a good sign, provided it be not due to increased uric-acid formation. This latter process may be set up by an increased intake of purin bodies, perhaps by alcohol or even certain drugs; but inorganic substances, as far as ascertained, produce no such result.¹

THE ALKALINE-CALCAREOUS OR EARTHY MINERAL WATERS

These waters contain calcium carbonate or sulphate and are valuable for their antacid and diuretic properties. As a rule, they are well borne by the stomach, counteracting hyperacidity of the stomach and urinary tract. For this reason they are largely used for the treatment of gout and rheumatism, but too large a quantity of calcium sulphate is a disadvantage to the stomach, and renders the water somewhat difficult of digestion.

It is noteworthy that even after the drinking of large quantities of mineral water containing calcium carbonate or sulphate only traces of calcium are found in the urine. Most of this is unabsorbed or is excreted by the large intestine. von Noorden shows that an important and beneficial reaction follows; that calcium in the intestinal canal before its absorption, and perhaps also during its re-excretion into the bowel, combines with phosphoric acid, and so prevents the latter's transference to the kidneys and urine. Thus the total amount of phosphates in the urine is diminished, and, as the reaction of the urine approaches alkalinity, the proportion of disodium to monosodium phosphates is modified in favor of the former.

Most of these waters in the natural state contain considerable quantities of carbonic acid gas, and, therefore, are best used at their source. Calcium salts are eagerly sought by the acids of imperfect digestion. The latter readily combine with the

¹ See Von Noorden, Metabolism and Practical Medicine, vol. iii, p. 949, English edition.

bases thus furnished, and probably in this manner obviate union with similar bases found in bone, cartilage of joints, and in other natural tissues of the body. A proper selection of food, such as vegetables rich in salts, accomplishes a similar purpose, and this diet goes hand in hand with the use of mineral waters in the treatment of these affections.

Calcareous mineral waters favorably influence rheumatism of a subacute or chronic type, gout, gravel, pyelitis from kidney connection, chronic gonorrhea, bronchial catarrh with profuse secretion, and allied affections. They are credited with favorable results in scrofulosis, rachitis, and osteomalacia.

The cold calcareous waters most used in the United States are those of the Healing Springs, Virginia (25 gr. per gallon); Bedford Springs, Pennsylvania (107 gr. CaSO_4 per gallon); Greenbrier White Sulphur Spring, W. Va. (78 gr. CaSO_4 per gallon); Clifton and Richfield Springs, New York (69 gr. CaSO_4 and 112 gr. CaSO_4 per gallon); Napa Soda Spring, California (10 gr. CaCO_3), and Manitou Springs, Colorado (65 gr. CaCO_3 per gallon).

The most extensively used thermal calcareous waters are at Hot Springs, Arkansas (7 gr. CaCO_3). Equally efficacious springs of this class are found in the Virginias, Kentucky, Michigan, New York, and Pennsylvania, some of them having rather more than local reputation.

In Europe cold earthy waters of wide reputation and popularity are found at Marienbad in Bohemia, Contrexéville in France, Wildungen in Germany, Leukerbad in Switzerland, and Bath in England. Of this class the waters of Contrexéville are best known and most used in the United States. The waters of Kreuznach, Germany, are of this class, containing chlorin, iodin, and bromin in combination with the earthy bases. They are used internally for tertiary syphilides and strumous diseases.

SALINE WATERS; MURIATED SALINE WATERS

Springs of salt water have been used for ages in Europe, the most famous being those of Homburg, Kissingen (Rakocsy),

Karlsbad (Sprudel), Soden, Friedrichshall, Nauheim in Germany; Hall and Salzburg in Austria; Cheltenham and Leamington in England.

In the United States the best springs of this class are those of Saratoga, Ballston Spa, Syracuse, and Glen Springs, New York; Mount Clemens, Michigan; Upper Blue Lick, Kentucky; Eureka Springs, California; and Waukesha, Wisconsin. There are numerous salt wells in Texas and Kansas. In Canada, Caledonia Springs, Sandwich Springs, and St. Catherine's Well, all in Ontario, have rather more than local reputation. They are purgative, and exert secondarily a good effect on the liver and gastro-intestinal functions. Their reputation having rested for years on a purely empiric foundation, it is highly gratifying to note the recent attempts to determine the true physiologic action of these waters.

Effects on Metabolism.—We are indebted to von Noorden, of Frankfort, and Carl Dapper, of Kissingen, for the best exposition of the effects of saline waters on metabolism.¹ Their observations were made on persons undergoing a drinking cure for various affections, comprising an acidity, subacidity, and hyperacidity of the gastric juice, chronic intestinal catarrh, gastric ulcer, obesity, diabetes mellitus, and the effects of alcohol. One observation made, and a curious one, was that in numerous cases of gastric disorder, particularly in gastric catarrh, the use of saline mineral waters leads to an active and permanent increase in the production of hydrochloric acid. On the other hand, in cases accompanied by hyperacidity, particularly in nervous dyspepsia, the moderate use of saline mineral waters leads to a decrease of the hydrochloric acid production and a decrease of the subjective symptoms. That a given remedy should work a cure in cases of a diametrically opposite nature is one of the paradoxes of medicine. But the high standing of these clinicians, and the great care shown in minute examinations made of the gastric secretion while the patients were

¹ Diseases of Metabolism and Nutrition, Part V, by Carl von Noorden and Carl Dapper; American edition by Boardman Reed, 1904.

under observation, leave no doubt that the conclusions are correct.

. In so refractory a condition as hyperaeidity no one mineral water has been found a panacea.¹

Another important point, brought out by the observations referred to above, is that the administration of saline mineral waters does not call for any particular diet. Arbitrary and routine dietetic regulations are in vogue at many health resorts. There is a popular prejudice among many physicians, and it is shared by the general public, that each particular saline water calls for the exclusion of certain definite articles of food from the diet regardless of the disease. In other words, that each water calls for a definite dietary. The governing principle should be that the diet should be adapted to the particular needs of the patient, and not be given in a routine way, according to the water prescribed. Although this antiquated method is not confined to European resorts, it is probably more commonly employed in Europe than in America.

That the use of fats should be forbidden while taking saline waters is one of the fallacies that the authors quoted above have pointed out. They make the valuable practical point that many patients need the fats of a normal diet to maintain their nutrition and strength. Undoubtedly, there are patients with gastric and intestinal trouble, with diabetes or gout, many neurasthenics and convalescents from various diseases who need fats, and who are perfectly able to digest and assimilate them. That they are assimilated the records plainly show.

The use of saline waters does not affect the proteid metabolism, and hence they are suitable in cases of overfatness in which it is never desirable to diminish the proteid contents of the body. Several investigators have published the results of experiments on animals and in healthy persons, showing a

¹ "To argue, as is done, that because simple saline waters are beneficial in subacidity, therefore they are contraindicated in hyperacidity, is a form of cleverness which rejects facts and opposes the free growth of knowledge."—von Noorden.

slight increase in the excretion of urea after the ingestion of sodium chlorid, but von Noorden's conclusion that proteid metabolism is not appreciably affected is generally believed to be correct. In adopting a milk diet the small quantity of salt present is not usually considered a disadvantage; water in this case is eliminated freely.

Saline waters should never be administered to patients with nephritis, especially when edema is present. This is now considered bad practice, and much light has been thrown on the danger of chlorid retention by the works of Widal and others. A salt-free dietary is enjoined, and hence chalybeate waters, calcareous waters, and other waters devoid of salt are to be chosen. An edema which has disappeared in the course of nephritis may be caused to reappear when salt is ingested. It is best to avoid salt in any case of albuminuria. We believe its use is positively counterindicated.

As a laxative and cathartic good saline waters like Congress and Hathorn have for years had a great reputation in the United States. All the Saratoga waters and those of Mt. Clemens have a large saline content.

It is impossible and, perhaps, unnecessary in this work to discuss fully the large question of the rôle of chlorid retention in nephritis. An excellent presentation of this subject was made to the American Medical Association in June, 1909, by Drs. Victor C. Vaughan, John H. Musser, Henry A. Christian, Edward F. Wells, D. L. Edsall, Rochester, Tyson, and others.¹

Widal and Javal's discovery has evidently influenced medical practice throughout the world. It is pretty well agreed that a reduction in the amount of sodium chlorid ingested, aside from any influence on edema, helps largely to reduce the work that the kidneys do; that an amount of sodium chlorid no more than that equal to what is taken in an ordinary daily diet may cause

¹ See full report in *Jour. Amer. Med. Assoc.*, November 27, 1909. See also *La Cure de Dechloruration dans le Mal de Bright et daus quelques Maladies Hydropigenes; Par le Dr. Fernand Widal et le Dr. Adolphe Javal*, Paris, Balliere, 1906; *ibid.*, *Bull. et Mem. de la Soc. Med. des Hôp. de Paris*, 1903, p. 733; *Delearde, L'Echo Med. du Nord*, January 20, 1907.

decided failure of function on the part of the kidney, even in cases in which the kidney appears to be doing fairly good work (Edsall). We, therefore, should be on our guard not to allow patients with scarlet fever or in any stage of nephritis to drink waters containing sodium chlorid in any appreciable quantity.¹

Regarding the excretion of the uric acid the conclusion is that in cases of gout the use of saline waters (*e. g.*, Kissingen, Rakocsy) causes an increase, amounting occasionally to as much as .2 grams a day, although in exceptional cases no change can be noted. In another case of gout, recently examined in von Noorden's laboratory, it was found that the use of saline and sulphate waters did not produce any increase of the fecal purins.

As an example of what may be expected, the following case of Dr. F. K. may be quoted: Age fifty-five; frequent attacks of gout for fifteen years. Chronic gouty changes in the joints with tophi in the ears and hands. There has been pain and swelling. The subject was obese, and showed great muscular weakness. He had a diet of meat, mashed potato, salad at dinner and supper, bread and butter, two oranges, a bottle of mild Bordeaux wine, and a bottle of Apollinaris water. For four days his average excretion of uric acid was .566 grams. For the next five days he was given 800 cc. Homburg Elizabeth water (686 gr. salt per gallon) in place of an equal amount of Apollinaris water. The average excretion of uric acid was then .765 grams. In the after-period, in which he returned to the original solid and liquid diet, the excretion was .695 grams. This shows that saline waters have a useful place in the treatment of gout. Similar cases are cited by von Noorden.²

There need be no interdiction of raw fruit while using saline mineral waters, unless the individual case demand it. The drinking of saline waters, or of any other water *per se*, does not call for the restriction of any particular article of food.

¹ The Hindu, Charaka, advised a salt-free diet in Ascites, 1000 B. C.

² Dr. Leonard Williams, of London, takes strong ground against the use of sodium chlorid waters in the treatment of gout, Jour. of Balneology and Climatology, Jan., 1907. The author heartily endorses this position.

SEA WATER

In a recent number of the *Répertoire de Pharmacie* M. P. Carles gives an interesting account of the use of sea water in medicine. In addition to common salt, sea water contains many important mineral substances, the total solid matter amounting to 3.2 to 3.8 per cent. Some of these substances are present only to an infinitesimal extent, but in biology the value of a substance is not necessarily dependent upon its actual size or quantity. It has been shown that various marine plants have the power of extracting from sea water minute quantities of compounds of iodin, bromin, arsenic, boron, manganese, lithium, fluorin, rubidium, cesium, and other elements. Hence it is not unreasonable to suppose that the higher animals might derive benefit from the assimilation of even minute traces of these physiologically active substances. The employment of sea water as a remedial agent dates back to the time of Hippocrates, and modern physiologic investigations have led to its reintroduction into medicine. Thus it has been shown that if a portion of the blood-serum of a dog be replaced by an artificial serum, the most suitable serum for the purpose is sea water, isotonic with the natural serum. Sea water has been given by the mouth and by injection with good results in cases of dyspepsia, loss of appetite, and tuberculosis. In general, the appetite was improved and strength was rapidly regained.

In order to obtain the best and most immediate results it is necessary to observe certain precautions. The sea water must be natural, as it is impossible to imitate so complex a liquid. Indeed, it has been proved that sea salt, when redissolved in distilled water, lacks some of the properties of natural sea water, exerting a toxic action upon a dog when injected subcutaneously. It must be freshly collected, as it loses carbon dioxid on standing, with precipitation of some of its salts. It should be taken from the open sea, remote from rivers and other sources of pollution. It should be sterilized by filtration, as heat dissociates the bicarbonates and destroys the natural equilibrium of the liquid.

When required for *subcutaneous injection* sea water should be diluted with water to the same concentration as normal blood-serum. Distilled water is not suitable as a diluent, as it sometimes causes pain. It is better to dilute the sea water with natural potable water in the proportion of 2 parts to 5. In conclusion, M. Carles points out that this method of treatment is not invariably suitable, and that it rests with clinical experience to indicate the cases in which it may advantageously be employed.¹

USE OF RADIO-ACTIVE WATERS INTERNALLY

Little is known of this use of mineral waters. They have been studied by Biekell and Bergell² in their laboratory, and a definite biologic action in relation to digestion is claimed, but we are far from any exact or satisfactory knowledge of the subject. It has been shown by M. Curie that any radio-activity present in mineral waters is dissipated shortly after bottling, the radio-active gas and water losing about 50 per cent. of its activity in four days. Consequently, efforts to bottle waters charged with radium gas will prove useless regarding their radioactive properties. Taken at their source they may, however, be valuable.

Bergell and Biekell say that the retarding effect of the peptonizing process which certain saline waters exert is found only when the water has lost its radio-activity. The presence of radium emanation, although by itself inactive as regards the process of secretion, either abolishes the retarding power of saline water or overcompensates it. Incomplete as these researches are, a good deal of truth lies in the statement that there is a real difference between the physiologic workings of a water, taken fresh from the spring at its maximum of radio-

¹ Lancet, January 4, 1908. See also R. Simon and R. Quinton, Société de Thérapeutique, Paris, January 24, 1906; also Quinton's L'Eau de Mer, Milieu Organique, Masson and Cie, Paris.

² Bickell and Bergell, Physiol. Bedeut. der Radioaktivität der Mineralwasser, xxii, Kongress f. innere Med., 1905, p. 157.

activity, and those of the same water altered by transportation and storage.¹

BITTER OR PURGATIVE WATERS

These belong to the class of sodic-potassic-magnesic sulphated muriated saline waters. The best examples are those of Puellna, Hunjadi, Apenta, Franz Josef, Victoria of Austria; Scidlitz, Bohemia; Carabaña and Rubinat, Spain. The waters of Crab Orchard and Harrodsburg, Kentucky; Abilene Spring, Kansas; Castalia Springs, California; and Clark's Riverside Spring, Michigan, are examples of the same class. They are purgative by stimulating intestinal peristalsis, stimulant to the stomach and to the flow of bile. The foreign waters of this class are used to an enormous extent in America for the relief of constipation, especially by plethoric persons.

The advantage of the Hunjadi waters is that the sulphates of magnesium and sodium are in nearly equal proportions, and the taste is not so objectionable as when one or the other preponderates. The strongest purgative water known is the Victoria Ofener. It contains a large proportion of magnesium sulphate and is a particularly disagreeable water. The Franz Josef Spring is a strong aperient, containing nearly equal parts of the sulphates of sodium and magnesium. The dose of these waters is a small wineglassful diluted with warm water; they should be taken in the morning on rising. Free purgation is obviously a great help in promoting a proper function of the stomach and the skin, and aids the action of drugs.

SULPHUR WATERS

These waters are characterized by the presence of hydrogen sulphid or the sulphids of sodium, potassium, calcium, or magnesium in connection with other salts, such as the chlorids of sodium and potassium and the earthy salts. Unless they contain at least 5 cubic inches of hydrogen sulphid per gallon or

¹ Confer von Noorden, Metabolism and Practical Medicine, vol. iii, p. 910, London, 1907.

5 gr. of sulphids, much stress cannot be laid on the sulphur as a potent factor. Waters of weaker composition are very numerous, and, though bearing the title of sulphur springs, are useful rather by reason of their thermal qualities or through other constituents, usually alkaline—saline. The advantages of these salts have been discussed. (See p. 403 *et seq.*)

When well charged with sulphur, these waters are useful in diseases of the liver and spleen, and probably also in gout, rheumatism, and such skin diseases as acne and scrofulous eruption. The list of sulphur waters is very long; they abound in New York, Virginia, West Virginia, Alabama, Michigan, California, and Ontario, Canada. In England the Harrogate waters have marked sulphurous properties; so also those of Strathpeffer, in Scotland, Aachen, or Aix-la-Chapelle of Rhenish Prussia, Baden and Nenndorf in Prussia; Luchon, Barèges, and Cauterets, in France; Baden near Vienna, and many others.

The opinion has been expressed that sulphureted hydrogen has been greatly overrated as a therapeutic agent in mineral waters, notwithstanding the general opinion of its virtues. Its value must be taken in connection with the mineral salts with which it is associated. In a case of nervous hyperacidity von Noorden has made some tests with the water of the Weilbach sulphur spring (5.2 cc. H₂S per liter); 400 cc. of this water were taken half an hour before the test-breakfast, and the stomach contents were removed by siphonage forty minutes after the meal. Four consecutive washings gave a total acidity of 91 (decinormal soda solution per 100 cc. of gastric juice) and an average for HCl of 62; after four washings the total acidity was reduced to 42. The general conclusion is that the water improves the appetite and stimulates the gastric functions. Where there is a moderate content of sodium chlorid this no doubt is the case; but where calcium sulphate is present in large quantities symptoms of indigestion are liable to occur.

CHALYBEATE WATERS; "STEEL WATERS" OF EUROPE

These waters contain from 1 to 150 gr. of ferrous sulphate or carbonate per gallon, and are usually combined with other more active ingredients. They are usually carbonated, and are agreeable to the stomach unless associated with much alum, when their astringent properties predominate. They are useful in the anemias and in general debility; when astringent, they are valuable in chronic diarrhea, ulcer of the stomach, malarial cachexia, gout, rheumatism, eczema, and psoriasis; when associated with arsenic, they are useful in chlorosis, scrofula, and other lymphatic diseases.

The principal simple iron waters in the United States are those of Iron Ute Springs, Manitou, Colorado; Rock Enon Springs, Va.; Napa Soda Springs and Pacific Congress Springs, California. In Europe the principal chalybeate springs are those of Bocklet, Franzensbad, Marienbad, Pyrmont, and Schwallbach, Germany; Tunbridge Wells, Flitwick, containing 170 gr. of persulphate of iron per gallon, Cheltenham, and Brighton, England; Spa, Belgium; and St. Moritz, Switzerland.

Among the astringent iron waters (FeSO_4) may be mentioned Church Hill Alum Spring, Rockbridge Alum, and Bedford Alum Springs, Virginia; Oak Orchard Spring, Genesee County, New York; St. Anne's Well at Brighton, England, belongs to this class.

Weak arsenic iron waters are found at Crockett Arsenic Lithia Spring, Virginia; at Ashley's Bromin and Arsenic Spring and Thompson's Bromin-Arsenic Spring in North Carolina. The best and strongest waters of this class are in Europe. Those most used are from Roncegno and Levico, in the Austrian Tyrol; Lansigk, in Saxony; and Royat, in the Puy de-Dome, France.

These waters are administered in doses of one or two tablespoonfuls daily and the dose is gradually increased. The Roncegno water contains .1 gram of arsenic per liter and the other waters from 4 to 9 milligrams. They should be well

diluted, and taken about half an hour after meals. The ferrous sulphate is present in quantities varying from 2.56 to 4.18 grams per liter (179 to 292 gr. per gallon). The Saint Victor Spring at Royat is used particularly for psoriasis.

Chalybeate waters always give the best results when taken directly from the spring, because, if much lime be present, as is frequently the case, the iron precipitates after bottling, and hence they do not bear transportation well. The waters of Schwalbaeh, on that account, keep better than those of Pyrmont, which contain lime in abundance. Those from the Prince de Condé Spa keep best of all, and may be given in quantities of from 1 to 4 or 5 tumblerfuls a day. They aid digestion and improve the blood.

Experience seems to show that the natural iron waters are more beneficial in chlorosis and anemia than the various pharmaceutical preparations of iron. This is probably due to its better solution. They are counterindicated when fever is present, in severe disturbances of the digestive organs, and in pulmonary tuberculosis with hemoptysis.

SODIC-BROMO-IODIN WATERS

Sodium bromid and iodid are found associated with sodium chlorid, and are quite subordinate to the excess of the latter salt. The chief European waters of this class are those of Kreuznach, Purton Spa, and Woodhall. The last is the strongest known, containing nearly 5 gr. of bromin and $\frac{2}{3}$ gr. of iodin to the gallon. The Saratoga Springs, such as Congress and Hathorn, Eureka, Excelsior, Champion, and Geyser, belong to this class, the Ypsilanti Mineral Well, the Port Huron Mineral Bath of Michigan, and about sixty others in the United States.

The bromo-iodin waters are of value in the treatment of serofula, syphilis, goiter, and diseases of the skin, but are counter-indicated in chronic inflammatory states of the digestive organs, unless the sodium iodid and bromid be insignificant in comparison with other valuable constituents.

LITHIA WATERS

These have a great vogue in the United States, and are widely advertised as such, whether they contain $\frac{1}{1000}$ gr. per gallon or upward. All the Saratoga Springs are, comparatively speaking, rich in lithia. The Londonderry and Buffalo lithia waters are widely used. The White Rock Lithia, a water from Waukesha, Wisconsin, is an artificial lithia water, to which 20 gr. of lithium carbonate was formerly added before bottling. It is no doubt fully as efficacious even now as any of the strictly natural lithia waters, and is very widely used as a table water. It is generally supplied carbonated.

"Buffalo Lithia is a water coming from an American spring or springs, advertised as containing a definite quantity of lithia, namely, 2.25 gr. per U. S. gallon, while the government analyses find much smaller amounts; and, according to the analysis made by Prof. F. Waller, the water contains but 0.018 gr. of lithium bicarbonate per gallon.

"Rhens water, the product of a German spring, is freed of its iron, recarbonated, and then bottled.

"Londonderry Lithia, an American water, advertised to contain 7.29 gr. per gallon, contains but a spectroscopic trace of lithia, an amount too small to be expressed in weight.

"Geneva Lithia Water, again an American product, said to contain 23.8 parts per million of lithia, is found to contain but 0.1 part; in other words, one would have to consume something like 80 gallons to get a single medicinal dose of the advertised drug.

"Bear Lithia, an American product, contains only a trace of lithia."¹

The late Dr. James K. Crook, who spent years in the study and classification of the American mineral waters, recognized that the medical profession are in a state of inexcusable ignorance regarding the chemic constituents of many of our mineral waters and the worthlessness of many advertised analyses.

"The fact must not be overlooked that the government anal-

¹ See article by Julius Greyer, Jour. Amer. Med. Assoc., Aug. 3, 1907.

yses were made in each case from samples purchased in the open market. It is, therefore, possible that some of the waters examined by the bureau chemists were spurious or adulterated.

"The chemic ingredients set forth in the table of contents of mineral springs represent hypothetic combinations only. No chemist maintains that the salts he sets down in his analysis exist in exactly that form in the water. He ascertains by his tests the various acid and basic ions existing in the water, and, as nearly as possible, in what amounts. He then reasons that they unite to form the salts which go to make up his hypothetic table of contents, which is presented as the analysis. It is hardly conceivable that any two chemists separately examining a specimen of spring water taken from its source, even at the same moment, would reach exactly the same result in stating the theoretic combination. How much greater discrepancy might reasonably be expected in the case of analyses separated by periods of thirty or forty years.

All of our medicinal springs should be submitted to analysis at least once in ten years, until we are able to arrive at a correct estimate of their potency, and whether they are gaining or losing in strength. No enterprising mineral spring proprietor, animated by a desire to put forth a reliable product, can object to the expense, repeated at intervals so widely separated. The decennial revisions of our works on *materia medica* and *pharmacy* should present a brief account of the mineral waters conforming to ethical rules; so that the medical practitioner may be in possession of as authentic and authoritative a source of information regarding these as he has in case of other therapeutic agents."¹

Among European waters containing lithia are those of Bilin, in Bohemia; Elizabeth-brunnen, at Homburg; Konigsquelle, at Elster in Saxony; Rakocsy Spring, at Kissingen in Bavaria, and Wilhemsquelle, at Ems, in Prussia.

Value of Lithia Waters.—These waters are credited with a solvent action on the uric acid, and hence they appeal strongly

¹ Therapeutic Gazette, May, 1908.

to those who believe that an excess of uric acid is the fundamental cause of rheumatism, gout, arthritis, and other allied conditions. This doctrine is usually given a prominent place in circulars regarding mineral springs, and is impressed on patients at various water-cure resorts so generally that it is a part of the confession of faith at most health resorts supplied with lithia waters. There should be a revision of the accepted teaching on this point: it is necessary to distinguish between the truth and poetry of uric acid.

The trend of all recent investigations leads to the conclusion that uric acid is only one of the numerous excrementitious products in the diseases in which it has been accorded such a prominent rôle. Nevertheless, its importance for trade purposes is such that no very radical change can be expected in this time-honored terminology.

Undoubtedly, lithia waters do good. If free from common salt and used with judgment and in moderation they are applicable in cases of nephritis of all grades, rheumatism, gout, especially of the chronic forms, and are unquestionably better than the glass of water in which the 5-gr. effervescent tablet has been dissolved. When lithia is given in the latter form it is too strong for prolonged use and is liable to derange the stomach. The natural waters, or those to which a quantity (not over 20 gr. per gallon) has been added, are free from these objections.

Under the provisions of the "pure food law" the United States Government has taken steps to insure proper labels on mineral waters, so that the public may not be misled. On May 3, 1910, in the United States Court at Harrisburg, Pennsylvania, a mineral spring water company was fined \$25 and costs for advertising its water to contain lithia in quantity to make it of medicinal value when analysis showed barely a trace.

WATER AS AN EMETIC

Finally, water may be used as an emetic. The time-honored use of lukewarm water, or slightly saline warm water, needs little comment. In cases of poisoning, especially in ptomain-poisoning, this simple remedy should be instantly applied.

COMPARISON OF THERMOMETERS

Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.
212	100	150	65.6	90	32.2
210	98.9	148	64.4	88	31.1
208	97.8	146	63.3	86	30
206	96.7	144	62.2	84	28.9
204	95.6	142	61.1	82	27.8
202	94.4	140	60	80	26.7
200	93.3	138	58.9	78	25.6
198	92.2	136	57.8	76	24.4
196	91.1	134	56.7	74	23.3
194	90	132	55.6	72	22.2
192	88.9	130	54.4	70	21.1
190	87.8	128	53.3	68	20
188	86.7	126	52.2	66	18.9
186	85.6	124	51.1	64	17.8
184	84.4	122	50	62	16.7
182	83.3	120	48.9	60	15.6
180	82.2	118	47.8	58	14.4
178	81.1	116	46.7	56	13.3
176	80	114	45.6	54	12.2
174	78.9	112	44.4	52	11.1
172	77.8	110	43.3	50	10
170	76.7	108	42.2	48	8.9
168	75.6	106	41.1	46	7.8
166	74.4	104	40	44	6.7
164	73.3	102	38.9	42	5.6
162	72.2	100	37.8	40	4.4
160	71.1	98	36.7	38	3.3
158	70	96	35.6	36	2.2
156	68.9	94	34.4	34	1.1
154	67.8	92	33.3	32	0.
152	66.7				

PRESCRIPTIONS FOR HYDROTHERAPY

It is necessary to specify the temperatures of the water to be used, the duration of each feature of the treatment, and, if douches are called for, the pressure required. These ought to be intelligently and concisely stated by the physician, as in a prescription for any other remedy. Abbreviations are naturally used and are understood by bathing attendants. In institutions where large numbers are bathing these prescriptions are kept in a convenient place, well lighted, for frequent reference during the progress of the bath.

The abbreviations most frequently used are as follows:

- L. B., Electric-light baths.
Pn., Perspiration.
H. A. B., Hot-air bath or electric-light bath. Either may be used.
C. D., Circular or needle douche.
R. D., Rain douche or descending douche.
S. D., Scotch douche or alternate jet douche.
F. D., Fan douche or spray douche.
J. D., Jet douche.
<, Increasing temperature to.
>, Decreasing temperature to.
Comp., Compress.
Fo., Fomentation.
Rev. Comp., Revulsive compress.
H. and C. Sp., Alternate hot and cold to the spine.
H. and C. Hd., Alternate hot and cold to the head.
Simul. H. and C. Hd., Simultaneous hot and cold to the head.
C. Comp., Cold compresses.
Pk., Pack.
Ch. Pk., Chest pack.
Dry Ch. Pk., Dry chest pack.
C. M. F., Cold mitten friction.
W. H. R., Wet hand rub.
C. T. R., Cold towel rub.
W. Sh. R., Wet sheet rub.
Dr. Sh. R., Drip sheet rub.
S. Gl., Salt glow.
Spg., sponge.
Alc. R., Alcohol rub.
O. R., Oil rub.
H. Ft. B., Hot foot-bath.
C. Ft. B., Cold foot-bath.
H. and C. Ft. B., Hot and cold foot-bath.
Lg. B., Leg bath.
H. $\frac{1}{2}$ B., Hot half-bath.
C. S. B., Cold shallow bath.
Alk. B., Alkaline bath.
E. L. B., Electric-light bath.
H. B. Pk., Hot blanket pack.
D. B. Pk., Dry blanket pack.
Elect. Pk., Electrothermal pack.

PRESCRIPTIONS .

In the Medical Baths of Boston, which have been established under the guidance of Dr. J. H. Pratt, Dr. J. J. Put-

nam, and others, there is an excellent system of prescriptions and medical observation and reports. See Hydrotherapeutic Prescriptions, by Joseph H. Pratt, Boston Med. and Surg. Journal, March 17, 1904; also, An Introduction to the Use of Hydrotherapy in Chronic Diseases, by J. H. Pratt. Among the prescriptions used by Dr. Pratt, Dr. Baruch, and the author are the following:

(1) Hot pack until skin is warm and cutaneous vessels dilated. Wet-mit friction with water at 60° F. (15.6° C.). Repeat daily, reducing water temperature 2 degrees daily until 50° F. (10° C.) is reached.

(2) Electric-light bath until skin is moist, or for five or ten minutes, followed by wet-mit friction, using cold water at 50° or 60° F. (10° or 15.6° C.).

(3) Hot-air cabinet bath until the skin is warm. Wet-mit friction with water at 60° F. (15.6° C.), reducing the temperature of water daily until water at 50° F. (10° C.) is used.

Nos. 1 to 3 are useful in anemia, neurasthenia, nervous dyspepsia, debility, malnutrition, etc.

(4) Hot-air bath or electric-light bath to perspiration. C. D., 105° > 80° F. (40.6° > 26.7° C.), two minutes; 20 pounds. F. D., 75° F. (23.9° C.), fifteen seconds. Alcohol rub.

(5) H. A. B. to Pn. (temperature 160° to 170° F.—71.1°—76.7° C.). C. D., 105° > 90° F. (40.6° > 32.2° C.), two minutes; 20 pounds. J. D., 90° > 80° F. (32.2° > 26.7° C.), one minute; 15 pounds. F. D., 80° F. (32.2° C.), ten seconds; 15 pounds. Lower minimum temperature 2 degrees and increase pressure 2 pounds each treatment, until a temperature of 60° F. (15.6° C.) and a pressure of 30 pounds are used. General tonic.

(6) H. A. B. to Pn., temperature 160° to 170° F. (71.1°—76.7° C.). C. D., 95° > 80° (35° > 26.7° C.), thirty seconds. F. D., 70° F. (21.1° C.), five seconds; 30 pounds. General massage, ten minutes. Reduce temperature of F. D. 1 degree daily.

(7) H. A. B. or electric-light bath, fifteen to twenty-five

minutes. Dry pack, thirty minutes. Rest in bed, one hour. This is useful in chronic parenchymatous nephritis and in anemia.

(8) H. A. B. or electric-light bath to Pn. C. D., $105^{\circ} > 90^{\circ}$ F. ($40.6^{\circ} > 32.2^{\circ}$ C.), two minutes; 20 pounds. Scotch douche (S. D.) to affected part or painful areas, thirty seconds. Repeat daily. Pressure to be regulated from 10 to 20 pounds, according to sensibility and general resistance. Useful in cases of arthritis.

(9) Vapor bath, 120° F. (48.9° C.), ten minutes. S. D. to painful parts, twenty to thirty seconds. Hot dry pack, thirty minutes. Rest in bed, one hour. Repeat on alternate days. Useful in neuralgia and in muscular and articular rheumatism.

(10) H. A. B. almost to Pn. C. D., $105^{\circ} > 95^{\circ}$ F. ($40.6^{\circ} > 35^{\circ}$ C.), one minute. S. D., small caliber, to course of colon, 115° and 60° F. (46.1° and 15.6° C.), fifteen seconds for each temperature; 15 pounds, one to two minutes. F. D. to chest and back, 75° F. (23.9° C.), ten seconds. Repeat daily, increasing pressure 2 pounds daily until 30 pounds are used. Useful in constipation.

(11) Hot-air bath until cutaneous vessels are dilated. Wet sheet rub. Sitz-bath, temperature 70° F. (21.1° C.), ten minutes. Simultaneous hot foot-bath, temperature 110° F. (43.3° C.). Repeat daily, increasing duration gradually to twenty minutes and lowering temperature to 50° F. (10° C.). Diarrhea.

(12) Hot-air bath to perspiration. Circular douche, 105° to 95° F. (40.6° – 35° C.), one minute. Ascending douche, 60° to 70° F. (15.5° – 21.1° C.), two to three minutes, 5 to 10 pounds' pressure. Rain douche, 105° F. (40.6° C.), thirty seconds. Fan douche to entire body, ten seconds, 15 pounds, 70° F. (21.1° C.). Hemorrhoids; hypertrophy of the prostate.

(13) Hot-air bath to point of perspiration. Circular douche, 105° to 90° F. (40.6° – 32.2° C.), two minutes. Jet and fan douche, 90° to 80° F. (32.2° – 26.7° C.), 15 pounds, one minute. Jet douche to spine, 75° F. (23.9° C.), fifteen seconds. Lower minimum temperature 2 degrees and increase pressure 1 pound

each application until pressure of 35 pounds and temperature of 50° F. (10° C.) are reached. General tonic.

(14) Hot-air bath until cutaneous vessels are dilated. Remove before perspiration begins. Circular douche, 95° to 85° F. (35°-29.4° C.), one-half to one minute. General fan douche, 80° F. (26.6° C.), 20 pounds, ten to twenty seconds. Dry rapidly. Walk in open air until somewhat fatigued. Repeat daily, reducing minimum temperature 1 degree each treatment. Once during week allow patient to perspire five minutes in cabinet.—*Baruch*. General tonic.

(15) Hot-air bath almost to point of perspiration. Circular douche, 95° to 85° F. (35°-29.4° C.), one-half to one minute. Fan douche to back, 75° F. (23.9° C.), 20 pounds, five seconds. General fan douche, 78° F. (25.6° C.), 30 pounds, fifteen seconds. After several days substitute jet douche for fan douche to back, lower temperature of general fan douche 1 degree daily.—*Baruch*. For neurasthenia.

(16) Hot-air bath to beginning perspiration. Circular douche, 25 pounds, 95° to 80° F. (35°-26.7° C.), one minute. Jet douche to back, 30 pounds, 75° F. (23.9° C.), five seconds, daily reduced 1 degree. Friction. Walk in open air.—*Baruch*. For neurasthenia of moderate grade.

(17) Hot-air bath to beginning perspiration. Circular douche, 10 pounds, 105° to 92° F. (40.6°-33.3° C.), three minutes. General fan douche, 10 pounds, 85° F. (29.4° C.), fifteen seconds. Walk slowly in the open air. Repeat daily, increasing pressure and lowering temperature until 15 pounds and 80° F. (26.7° C.) are reached.

(18) Hot-air bath to point of perspiration. Change cold compresses to head frequently. Circular douche, 100° to 90° F. (37.8°-32.2° C.), two minutes. Scotch or alternate jet douche to legs and feet, 15 pounds. Repeat daily, increasing pressure 1 pound each application until 30 pounds are borne. Arthritis of the feet.

(19) Wet pack; temperature of water 60° to 70° F. (15.6°-21.1° C.), one hour. Circular douche, 85° F. (29.4° C.), 20

pounds' pressure, fifteen seconds. Repeat daily; once or twice weekly initial temperature of circular douche, 90° F. (32.2° C.), reduce quickly to 75° F. (23.9° C.), followed by fan douche, 85° to 65° F. (29.4°–18.3° C.), 20 pounds' pressure, five seconds.

—*M. P. Jacobi and Baruch.*

(20) Hot-air bath to perspiration. Circular douche bath, 25 pounds' pressure at 80° F. (29.4° C.), thirty seconds. Spray douche, 65° F. (18.3° C.), five seconds. After a few applications, use jet douche to spine at end of treatment for three seconds, temperature 65° F. (18.3° C.). Lower temperature of jet 2 degrees daily until 50° F. (10° C.) is reached. If this is well borne, pressure may be increased 2 pounds daily until 30 pounds are reached.—*Baruch.*

(21) Vapor bath, 120° F. (48.9° C.), 15 minutes. Ice-bag to precordia. Salt glow. Jet douche to entire body, 10 pounds, 110° F. (43.3° C.), thirty seconds. Rub dry. Rest in bed one to two hours. Repeat two to four times weekly, increasing pressure until 30 pounds are employed, and gradually increasing length of vapor bath to thirty minutes. For chronic parenchymatous nephritis.

(22) Hot full bath, 100° F. (37.8° C.), raised to 106° F. (41.1° C.), five to ten minutes. Salt glow. Fan or jet douche to entire body, 110° F. (43.3° C.), thirty seconds. Massage to edematous portions. Rest one to two hours before dressing. Repeat two to four times weekly, increasing pressure until 30 pounds are used. For chronic parenchymatous nephritis.

(23) Hot-air bath, forty to sixty minutes. Soap shampoo. Half-bath, temperature 70° F. (21.1° C.), three to five minutes. General jet douche, pressure 25 pounds, temperature 70° F. (21.1° C.), twenty seconds. Dress quickly and walk until fatigued. Repeat daily, increasing duration of hot-air bath and lowering temperature of douche as condition of patient indicates.

Prescriptions in use at the Medical Baths, Boston:

Prescription A.—Light cabinet, five to seven minutes

Cold wet mit friction to entire body.

Temperature of water, 70° F. (21.1° C.).

Repeat daily, gradually reducing temperature of water to 60° F. (15.5° C.) or lower.

Prescription B.—Light bath, five to ten minutes.

Circular douche, 105° F. (40.5° C.), thirty seconds.

Circular douche, 90° F. (32.2° C.), thirty seconds.

Jet and fan douche to entire body at 70° F. (21.1° C.), twenty seconds, pressure, 10 pounds.

Repeat daily, gradually increasing pressure of jet douche and lowering terminal temperature until pressure of 20 pounds and temperature of 60° F. (15.5° C.) are used.

It is written in an abbreviated form as follows:

L. B., five to ten minutes.

C. D., 105° F. (40.5° C.), thirty seconds.

C. D., 90° F. (32.2° C.), thirty seconds.

J. and F. D., 70° F. (21.1° C.), twenty seconds.

P., 10 lb.

Repeat daily, increasing P. to 20 lb. and reducing T. to 60° F. (15.5° C.).

Prescription C.—Light bath, fifteen to twenty minutes.

Fan douche, 105° F. (40.5° C.), thirty seconds.

Fan douche, 70° F. (21.1° C.), fifteen seconds.

Dry rub.

Rest one hour.

Repeat every other day.

If the individual is weak, a milder procedure should be used (Prescription A).

Prescription D.—Light bath, seven to twelve minutes.

Salt rub.

Circular douche, 105° F. (40.5° C.), thirty seconds.

Jet and fan douche, 105° F. (40.5° C.), thirty seconds, pressure, 15 pounds.

Dry rub.

Rest thirty minutes.

Repeat three times weekly.

Useful in chronic interstitial nephritis.

In cases of chronic uremia, headache, loss of appetite, and vomiting it is well to use a wet pack (one hour or longer) preceded by a light bath of three to five minutes' duration.

Prescription E.—Local hot-air or electric-light bath to affected joint, thirty minutes to one hour.

Electric-light bath, general, three to five minutes.

Jet douche to affected joint, 105° F. (40.5° C.), twenty seconds.

Jet douche to affected joint, 105° F. (40.5° C.), twenty seconds; 70° F. (21.1° C.), five seconds.

Repeat four times.

Circular douche to entire body, 105° F. (40.5° C.), thirty seconds.

Jet and fan douche to entire body, 70° F. (21.1° C.), ten seconds.

All douches at from 10 to 20 pounds' pressure.

Repeat three to six times weekly, increasing pressure gradually.

Prescription F.—Arc light, seven to ten minutes.

Light bath, five to ten minutes.

Alternate douche to affected part.

Circular douche, 105° F. (40.5° C.), thirty seconds.

Jet and fan douche, 70° F. (21.1° C.), ten seconds, pressure, 10 pounds.

Repeat daily, increasing pressure gradually.

Used in lumbago and sciatica.

Prescription G.—Hot-air douche to painful area, fifteen to twenty minutes.

Light bath, five to ten minutes.

Circular douche, 105° F. (40.5° C.), thirty seconds, pressure, 10 pounds.

Jet and fan douche to entire body, 70° F. (21.1° C.), twenty seconds, pressure, 10 pounds.

Repeat daily. Increase pressure of jet and fan douche and lower terminal temperature until pressure of 25 pounds and 60° F. (15.5° C.) are reached.

Nauheim Baths.—At the beginning of treatments the following general prescription may be given:

Prescription H.—Carbon dioxid bath, $\frac{3}{10}$ strength.

Temperature, 93° F. (33.8° C.).

Duration, seven minutes.

Increase strength one-tenth each treatment, lower temperature 1 degree, and increase duration one minute.

Prescription I.—Carbon dioxid bath, $\frac{3}{10}$ strength.

Temperature, 93° F. (33.8° C.).

Duration, ten minutes.

Increase strength of bath gradually, lower temperature and increase duration until a bath of eight-tenths full strength 87° F. (30.5° C.) and twenty minutes is given.

Dr. Pratt finds that a powerful arc light is of service in the treatment of neuritis, myalgia, "rheumatic" joints, and neural-

gia, particularly sciatica. The arc light in use at the Medical Baths in Boston has a concave parabolic mirror, so that the rays of light can be focused on a small area of the skin.

In *obesity*, Dr. Pratt usually uses light baths followed by cold douches (Prescription D). Later in the treatment dry blanket packs or hot full baths (105° F.— 40.5° C. for ten or fifteen minutes) are used after the light bath if prolonged sweating is desired. Hydrotherapy without careful attention to diet and exercise is valueless in the treatment of obesity.

In *chronic interstitial nephritis*, short stimulating douche treatments (Prescription D) and carbon dioxid baths hold the first place.

In *diabetes*, Naunyn and von Noorden recognize the importance of hydrotherapeutic aids to the dietetic treatment. Tonic measures increase metabolism, invigorate the patient, and improve the condition of the skin (Prescriptions A and B).

Local Hot-air and Light Baths.—In *chronic arthritis* of all forms we chiefly use local light and hot-air baths followed by a cabinet bath of short duration, and then give an alternating (Scotch) douche to the affected or painful areas. (See Prescription E.)

Nauheim Baths.—Dr. Pratt informs the author that he usually begins a course of treatments with baths two-tenths or three-tenths full strength. The duration of the first bath is seven minutes and the temperature of the water 93° F. (33.8° C.). Gradually the strength of the bath is increased, the temperature lowered, and the duration extended to fifteen or even twenty minutes. He rarely gives a bath at a lower temperature than 86° F. (30° C.).

A full strength bath is only used if the heart has considerable reserve power, and then only toward the end of treatment.

Use in Heart Disease.—The carbon dioxid baths are indicated in the milder degrees of circulatory disturbance, when there is slight dyspnea on exertion or moderate edema. They may also be of value in *cardiac asthma* (paroxysmal dyspnea, usually nocturnal) and in milder forms of *angina pectoris*. They are of equal service in the cardiac weakness of valvular disease and in

that due to myoecdial degeneration alone. They are contraindicated when there is oppressed breathing with the patient at rest or when edema is marked.

The circulatory organs can be acted on reflexly by stimulating the sensory nerves of the skin, and the most powerful stimulus of the cutaneous sensory nerves is the carbon dioxide bath. The peripheral vessels are narrowed, but as there is an increased flow of blood through them, the skin becomes reddened and there is a pleasant sensation of warmth produced. The blood-pressure is elevated. The altered distribution of the blood in the body is an aid to the proper functioning of the heart. The breathing becomes deeper and this also accelerates the flow of blood.

If the bath is not too strong, it produces a slight rise in blood-pressure when given at a temperature between 85° F. (29.4° C.) and 92° F. (33.3° C.). In treating heart cases the physician should carefully note the immediate effect of the treatments. He should be present occasionally when the strength of the bath is increased. It is important to percuss out the cardiac outline before and after the bath.

Dr. Pratt is a firm believer in the superiority of the local incandescent light baths over local hot-air baths. The radiant heat of the light bath penetrates the tissues to a greater depth than the conducted heat of the hot-air bath.

The following is a list of general stimulating treatments most commonly used at the Medical Baths in Boston:

- (1) The ablution (wet-mit friction, German "Teilwaschung," see p. 246). A mild general treatment.
- (2) The wet sheet pack and rub (see p. 237).
- (3) The half-bath. Temperature 70° to 85° F. (21.1°-29.4° C.). Duration one to five minutes (see p. 243).
- (4) The douches:
 - (a) Circular douche, 60° to 70° F. (15.5°-21.1° C.). Pressure, 8 to 15 pounds; duration, fifty to sixty minutes.
 - (b) Jet and fan douche, 60° to 75° F. (15.5°-23.9° C.). Pressure, 10 to 25 pounds.

(5) The faradic electric baths. Temperature, 90° to 93° F. (32.2°-33.8° C.).

(6) The carbon-dioxid baths. Various strengths; temperature, 85° to 92° F. (29.4°-33.3° C.). Duration, seven to fifteen minutes.

The chief sedative treatments are as follows:

(1) The wet pack (see p. 340).

(2) The dry blanket pack (see p. 345).

(3) The hot-air bath. Temperature, 115° to 140° F. (46.1-60° C.); duration, fifteen to twenty-five minutes.

(4) The electric-light bath. Temperature, 110° to 140° F. (43.3°-60° C.); duration, fifteen to thirty minutes.

(5) The neutral full bath. Temperature 90° to 93° F. (32.2°-33.8° C.); duration, ten to forty-five minutes.

(6) The hot full bath. Temperature, 104° to 108° F. (40°-42.2° C.); duration, five to ten minutes.

(7) The galvanic bath. Temperature, 90° to 93° F. (32.2°-33.8° C.); duration, five to fifteen minutes.

(8) The sinusoidal bath. Temperature, 90° to 93° F. (32.2°-33.8° C.); duration, five to fifteen minutes.

(9) Electric-light bath, five to ten minutes.

Circular douche at 105° F. (40.5° C.), thirty seconds.

Circular douche at 90° F. (32.2° C.), thirty seconds.

Jet and fan douche to entire body at 70° F. (21.1° C.), twenty seconds; pressure 10 pounds.

Repeat daily, gradually increasing pressure of jet douche and lowering terminal temperature until pressure of 20 pounds and temperature of 60° F. (15.5° C.) are used.

Local treatments with heat produce hyperemia and are used chiefly to relieve pain, to lessen inflammation, and to improve the nutrition of the affected part. They are most useful in the treatment of the various joint troubles, neuralgia, neuritis, and muscular affections.

(1) Electric-light (incandescent) bath.

(2) Arc-light with reflector.

(3) Hot-air bath.

- (4) Hot-air douche.
- (5) Hot-water douches:
 - (a) Simple hot douche.
 - (b) Scotch douche.
 - (c) Alternating douche.
- (6) Fomentations.

REQUISITE EQUIPMENT FOR AN INSTITUTION

The chief apparatus is as follows:

- (1) Electric-light cabinet. This is a cabinet or box lined with plate-glass mirrors and lighted with eight rows of six incandescent lights.
- (2) Two cabinets for hot-air and vapor baths.
- (3) Incandescent electric-light bath for treating single parts of the body.
- (4) Arc-light with reflector for local treatments.
- (5) Local hot-air bath.
- (6) Douche-table with which a large tank for hot water and a pressure pump is connected. The temperature and pressure are controlled by valves and the readings are easily made on the thermometers and gauges. (See pp. 282 and 283 for illustrations.)
- (7) Circular douche or needle bath.
- (8) Rain douche, descending, or shower-bath.
- (9) Horizontal douche, or spout:
 - (a) Jet douche, single or double, for Scotch douche.
 - (b) Fan douche.
- (10) Ascending or perineal douche.
- (11) Sitz-bath.
- (12) Porcelain tub used for carbon-dioxid baths, half-baths, full baths.

When desired, electric baths may be given in the tub.

APPENDIX

SOME TRUTHS ABOUT HYDROTHERAPY¹

BY SIMON BARUCH, M. D., NEW YORK

THE material and professional interests of the physician have been seriously injured and menaced by his neglect of physiologic remedies. The fact is demonstrated by the revolution in medical education which the advent of the *Naturarzt* produced in Germany, and which I witnessed in 1890, when the priest Kneipp was in the zenith of his meretricious fame.

In this paper I shall advert only to the remedial application of water, which is acknowledged to be the chief physiologic remedy by Marcuse and Strasser in their new "Monatschrift fuer die Physikalisch-diætetischen Heilmethoden."

For half a century Winternitz, of Vienna, had been striving to make hydrotherapy "the common property of the medical profession." To this end he had urged his colleagues to learn, teach, and practice it, but his warnings and appeals remained without effect until the *Naturarzt* began to menace the material interests of the German doctor. When this unexpected danger was realized, systematic efforts were inaugurated to meet the invasion of these empirics, who sprang up everywhere, prompted by the prospective harvests. A commission for the revision of medical studies, with Professor Kussmaul as chairman, was appointed, which, after due investigation, reported as follows:

"There is no doubt that trust in the prescription is waning among educated people and that the confidence in dietetic

¹ Delivered by invitation before the Boston Society for Medical Improvement, on Feb. 8, 1909. Included by permission of his friend, Dr. Baruch, the most distinguished advocate of hydrotherapy in America (Boston Med. and Surg. Jour., April 15, 1909).

remedies and in the remedial value of water is in the ascendant. Water has especially won for itself steadily growing confidence as a remedy. Hydrotherapy combined with diet may, undoubtedly, bring about or aid in the cure of numberless acute and chronic diseases. Of hydrotherapy the young physician knows nothing when he leaves the university. *Unhappily, he sooner or later may encounter discomfiture when an uneducated water-doctor steps in and cures the patient after he has failed.* Herein lies a great gap in the education of our physicians. A revision of our course of study must be made above all things; distinct chairs and clinics are demanded, in which appropriate cases may be treated by hydrotherapeutic procedures."

This brief extract from the report of the commission furnished clear proof of the incursion of the quack upon the status of the medical profession in Germany, and pointed out the remedy in emphatic terms. The result was remarkable, for in a very short time the principal German universities established clinics for hydrotherapy and other physical remedies, in which the development of physical therapeutics began.¹

Thus it has come about that a menace to material interests speedily accomplished that which Winternitz had failed to do by earnest and persistent effort during a half century. This historic fact, which may be corroborated by other proofs, is cited here as a warning and lesson to the medical profession of our own country. Our material interests have already been

¹ During a visit to Germany last spring I discovered that the *Naturarzt* is still active despite the numerous well-equipped clinics on hydrotherapy and other physical methods. The reason lies, probably, in the fact, which was ascertained by personal visits to or correspondence with all the larger universities, that *attendance upon these clinics being optional, very few students attended them.* In three universities there were no applicants at all for instruction in physical therapy; in one I saw five students; and only in Leipzig did I find a respectable number obtaining excellent instruction from Dr. Steinert, the chief of Curschmann's clinic. This observation justifies my insistence upon obligatory attendance of the lectures, of instruction of sections, and of a final examination as the *sine qua non* of the chair of hydrotherapy in Columbia University. These conditions have been satisfactorily executed, and only in this manner may the study become practically useful to student and teacher.

seriously damaged by empirics of high and low degree—Christian Scientists, osteopaths, water-cure doctors, vibrationists, and their ilk. Is it not our imperative duty to ascertain the cause of the defection of our patient to the empirics?

It behooves us to study and apply drugs less insistently and to devote more effort to a better comprehension of the remedial action of water and other physical remedies and of those psychic agencies which the lay doctor and empiric manage so successfully. All these may certainly be applied with more skill and judgment, and, therefore, with better results, by the educated physician, who thus may advance not only his material interests, but also the more humane and more lofty interests involved in the amelioration and cure of disease.

(1) That a better understanding of the rationale of the action of water in disease may lead to the saving of life is a proposition not difficult of proof.

Example 1.—For twenty years I have endeavored to impress upon my colleagues in this country that in the application of the bath in infectious fevers the antipyretic is secondary to the nerve-stimulating and sustaining effect. Prompted by the fact that many lives were being sacrificed by disregard of this vital principle of hydrotherapy, I spared neither sacrifice of time nor effort to establish it by addresses delivered by invitation from medical schools or societies in New York, Philadelphia, Boston, Albany, Baltimore, Chicago, St. Louis, Buffalo, Charleston, S. C., Richmond, Va., San Francisco, and Los Angeles, besides other smaller cities. Fear of shock had long operated against the adoption of effective cold procedures, because of the erroneous antithermic idea of the cold bath, a fallacy which Hippocrates combated. Physicians had been taught to increase the dose of castor oil, morphin, or other medicine if they desired an intensified effect; hence they naturally ordered the cold bath made colder when the temperature did not yield. As a result they obtained depression from injudicious dosage, and they rejected a remedy which judiciously used would have produced quite different effects.

The cold bath, indeed, every cold procedure, has for its chief object the enhancement of the resisting capacity of the patient to the disease. In an acute disease like typhoid fever this is accomplished, first, by the well-known primary effect of cold in contracting the cutaneous vessels. This is followed by reaction, which is manifested by a tonic dilatation of the vessels, whose walls had previously been in a semiparetic state by reason of the prevailing toxemia. The heart is thus materially aided in its labor to overcome the unresponsive condition of the peripheral vessels. Heart failure, which stands as a specter at the bedside of every case of infectious fever, is not due so much to enfeeblement of the cardiac muscle by hyperpyrexia as to the imperfect action of the peripheral vessels, which allows the blood to glide through them without resistance. Cold water applied with friction stimulates the cutaneous arterioles to a more nearly normal action; it increases peripheral elasticity and resistance and enables the heart to renew its energy. Arterial tension is increased, the danger of failure of the laboring heart is overcome.

(2) The excitation of the terminal filaments in the skin which follows the repeated impact of cold water is rapidly conveyed to the central nervous system and thence reflected upon the life-maintaining organs whose functions have been more or less impaired by the existing toxemia. Each bath or other cold procedure gives a fillip to the depreciated nerve-centers and sends new life to the organs depending upon them. The whole machinery of the organism receives a refreshing impetus, the impression being more or less enduring according to the temperature, duration, and procedure to which the patient is subjected. All this is now recognized by the well-informed physician, and yet nearly every text-book refers to the cold bath under the caption of heat-reducing agents, and few emphasize the truth that the correct cold bath is an *antifebrile* remedy which meets in fevers all therapeutic indications, of which *temperature reduction is only one*. A far more important truth than this even still appears to lack appreciation, viz., that the cold bath is not a symptomatic remedy, but that its value is due to the

prophylactic action in infectious fevers. It has been clearly demonstrated by large bedside observations that the early and correct application of hydrotherapeutic procedures in fever prevents complications and saves lives by removing from the causes of death heart failure, perforation, hemorrhages, and hypostases. Upon the recognition of the prophylactic effect of judicious bathing begun in the first week of typhoid fever the Brand method is based, and only to the neglect of this principle is due the failure of the latter. That thousands of lives have been saved by the correct application is evident from Vogl's statistics, the reports of the German Army, and their corroboration in our country by Peabody, Wilson, Loomis, Osler, Thompson, myself, and others. Dr. Gilman Thompson states in his Text-book on Practice that the mortality of typhoid fever was reduced from 16 to 6 per cent. in the Presbyterian and in the New York hospitals, since the introduction of the Brand bath, and the late Dr. H. P. Loomis reported to the Practitioners' Society of New York, in 1903, that the mortality from typhoid fever in the principal New York hospitals had been reduced 50 per cent. since the introduction of the systematic use of the Brand bath. Bear in mind that the evidence is furnished by professors of medicine in two large medical schools. Comparing the number of deaths from this disease in previous years, it may be safely computed that 1000 lives have been saved in New York City alone by the correct application of water in one disease. If it be borne in mind that private practice, in which bathing may be begun earlier than in hospitals, where patients are brought in late in the disease, offers a far more favorable field for this treatment, it becomes quite apparent how many lives are sacrificed by the neglect of this procedure.

Example 2.—The management of cases of isolation (heat-stroke, sunstroke) has been for several decades by cold baths, ice-packs, and similar heroic procedures, based on the fallacious idea that temperature reduction may best be accomplished by them. The loss of life which was positively attributable to this irrational practice will be clearly shown in another part of this

paper. Several hundred lives were sacrificed in one summer by the neglect of the well-established principle of hydrotherapy that the coldest bath is not the most antithermic procedure, and that the most successful therapy of sunstroke must be the more rational method, based upon stimulation of the nervous system, as the chief therapeutic indication, just as it is in infectious fevers.

Example 3.—In 1892 I reported to the New York State Medical Society the striking results of judicious hydrotherapy in phthisis pulmonalis, produced by its favorable effect upon nutrition and hematosis. In my work on hydrotherapy there appears a record of similar results observed by others in large numbers, which may be regarded as a control therapeutic experiment. Dr. Kuthy, of the great sanatorium of Budapest, compares his results with those of another large institution at Belzing, near Berlin. The records show 14 per cent. more restorations under the mild systematic hydrotherapy of Budapest than under the strong douches of Belzing. Although these statistics were published several years ago, their lesson has not yet been utilized in American sanatoria. I have sought in vain for any allusion to hydrotherapy in the Tuberculosis Congress. Indeed, I am credibly informed that one of our noted sanatoria, where a complete hydriatic equipment was installed, and which by request I visited at much sacrifice of time and trouble to instruct the staff and nurses, no longer uses the apparatus. Shall we continue to be laggards in this valuable method and withhold from these desperate cases so valuable a means of enhancing their resisting powers?

The Remedy.—How is the prevailing neglect of hydrotherapy to be removed? To the unbiased inquirer the answer is simple. The cause is ignorance of the physiologic and therapeutic action of water, and the remedy is its removal by instruction in our schools (as indicated in Kussmaul's report), the study, however, being made obligatory, and reading by the general practitioner of works on hydrotherapy.

Until the report of the Kussmaul commission appeared, the

Vienna University was the only medical school in which hydrotherapy was taught. Very few physicians, consequently, applied it in practice outside of institutions. True, as in all periods of medical history, a few wise men advocated the remedial uses of water in recent times with earnestness born of conviction. Erb, Charcot, and Semmola, in their respective countries, prescribed it constantly, but unfortunately their prescriptions lacked precision, and were, therefore, empirical.

In Ziemssen's Cyclopedie, for instance, Erb wrote: "Among the most powerful and effective agents in our branch are cold and cool baths and the water treatment. Its results in all possible chronic nerve troubles are *extraordinarily favorable*." Aside from these laudatory statements, Erb offers no directions to guide those who would fain obtain the same "extraordinary" and "powerful" results of the "cold-water treatment." The reason may be found in the fact that Erb entrusted his patients to institution doctors who have not transmitted their special methods to us. The result was a blind groping in the dark and consequent failure, which may be demonstrated by numerous examples. Let me cite one illustration published in the *International Clinics*. A well-known neurologist tells his class: "The best remedy for neurasthenia is cold water in the morning. Let the patient stand in warm water and with a sponge pour cold water, or very cold water, over his head, shoulders, and nape of the neck, etc." The temperature of the cold and very cold water, the duration of the procedure, the friction needed for feeble individuals, the frequency of repetition, are not mentioned, and yet when this professor comes to speak of strychnin and the phosphates he becomes precise in stating dose, form, and mode of administration, etc. If specialists teach hydrotherapy so vaguely, the practitioner naturally ignores this "powerful," "extraordinary" agent and plies the patient with drugs, with the application of which he is more familiar. Failure and disappointment to physician and patient alike are inevitable.

The Charcot douche has come down to us sanctioned by the great name of the man who applied it chiefly in hysteria.

Does any one know to-day the temperature, duration, or pressure Charcot prescribed for this douche? All we know is that it is a strong jet or stream driven upon the spinal column. So far as I am informed, specialists order it generally without regard to these essential elements because the latter have not been transmitted to posterity. A few days ago I discovered type-written instructions in a large hospital erroneously describing the Charcot douche as one of alternating temperatures. Failure is more frequent than success, as a long connection with institutions has demonstrated to me. Were it not pathetic, it would seem absurd to find an eminent neurologist order "hot box and Charcot douche" for most of his cases of neurasthenia. He leaves the duration of the "hot box" (which is the cabinet) and the temperature and preparation of the douche to the attendant, who certainly knows less of the physiologic action of water than the druggist knows of medicines, and yet this gentleman is so careful with the latter that he directs patients where to obtain parathyroid tablets or other important drugs which he prescribes. How can the students master the technic of his hydrotherapy if he himself is so indefinite in its prescription?

That the most frequent result of indefinite prescriptions of water is failure, and not rarely a change of doctors and resort to quacks, has been often demonstrated. Clearly, if the leaders in medicine had themselves received the same instruction in the rationale and therapeutics of water which was given them in drugs, they would have taught hydrotherapy as they teach drug-therapy; the young practitioner would not find himself in the sad plight depicted by Kussmaul; he would be armed with a powerful weapon against disease and quackery.

In the present status of this subject, the judicious practitioner would act wisely to altogether dispense with water in therapeutics unless he be at least as familiar with its action as he is with the effect of medicinal agents, or is able to obtain counsel on its application. The former is not as difficult as it would appear from the vague mention of baths, packs, drip sheets, in books of reference. *The average text-book must be avoided by*

the seeker of knowledge in hydrotherapy. It were an act of inexcusable temerity on my part to make this statement did not the facts warrant it and the occasion demand it. Text-books on therapeutics and practice in every language may be cited as proof of the utter unreliability as guides in the application of water in disease. Let me offer a few examples:

(a) In a recent vade mecum of therapeutics, translated from the German, and popular among Italian physicians, the translator mentions in his otherwise valuable annotations—*impacchio umido*—the wet pack around the trunk as valuable in pneumonia. Whether this wet pack is to be cold, warm or hot, its frequency, duration, and mode of application—these are left to the fancy of the doctor who consults this otherwise valuable book for guidance.

(b) In a paper on pneumonia of children read before a medical society and published in the Archives of Pediatrics, an eminent pediatrician states: "When the temperature is 103°, 104°, 105°, or 106° F. (39.4°, 40°, 40.5°, or 41.1° C.) I apply cold baths and cold packs. Cold water is the best antipyretic." The fact that cold water means water from the cold faucet, and the more important truth, that tepid water is a better antipyretic than cold water, are entirely disregarded. Cold water ranges from 35° to 75° F. (1.6°–23.9° C.) as it comes from the "cold" faucet at different seasons and in different countries. The wise practitioner would do well to avoid even baths of 75° F. (23.9° C.) in the pneumonia of children. Although the temperature and technic of the cold baths and packs which the eminent pediatrician recommends are not regarded by him as worthy of mention, his directions for the preparation and dosage of his favorite drugs are emphasized minutely. He ingenuously admits, too, that he was asked to resign from a hospital on account of his predilection for cold baths.

(c) In an excellent English work on the "Action of Medicines," which has been a text-book in many American schools, the "cold bath" is referred to among "the best antipyretics," and its technic described as a bath of 65° F. (18.3° C.), reduced by ice

to 40° F. (4.4° C.), the patient lying in this bath until his temperature is reduced! The lecturer, fortunately, insists on guarding against collapse, which would be equivalent to a recommendation of dangerous doses of strychnin with a warning to watch for opisthotonus. Not a word is said of friction, the most important element of all cold baths, and the physiologic fact that such a bath would increase the body temperature instead of reducing it, as has been demonstrated by Liebermeister and others, is lost sight of by an author whose greatest merit is the rational basis of his therapeutic teaching.

(d) Another very popular American text-book on therapeutics displays ignorance of what any one in hydrotherapy would know by stating that "a douche falling more than 10 feet is neither proper nor safe." I have seen thousands of douches administered with water that fell 60 feet, and in our own institution here you may observe that so feeble a douche is never used. The absurdity of this author's warning is obvious, and serves to illustrate my proposition that even the best text-books are false guides on hydrotherapy.

(e) A work on the treatment of nervous diseases describes the drip sheet as a sheet wrung out of cold water. The tautology is self-evident and proves a lack of practical acquaintance with hydrotherapy, and that the author has simply copied from other faulty works.

Most text-books on practice of medicine are equally unreliable as guides in the use of water in disease.

There exists a want of unanimity and absence of definite instruction in the description and effect of hydrotherapeutic procedures, if these are mentioned at all, among authors which is in striking and painful contrast to their universal agreement upon the application and dosage of drugs and other remedial agents. This absence of precision naturally intimidates the physician who consults these works, and imbues him with the idea that water is inferior to drugs. Moreover, while the otherwise able and conscientious authors keep abreast of the progress of their subject in all other respects, they appear to ignore

the most reliable contributions to the literature of the water treatment. One example, briefly referred to already, may suffice to prove this statement. In 1897 Dr. Alexander Lambert, of Bellevue Hospital, New York, read before a medical society and published in the Medical News a paper containing the largest modern statistics on sunstroke. These were gathered from hospital records, read before a medical society and published in a prominent medical journal; the number of cases treated by each method and the results were clearly stated, and their similarity of type is established by their simultaneous occurrence in one week. The mortality under the graduated bath of 110° to 72° F. (43.3°–22.2° C.) in the Brooklyn Homeopathic Hospital was 41.17 per cent.; the mortality under ice-baths (Bellevue Hospital) was 33.33 per cent.; under affusions and douches with water at prevailing temperature, 70° F. (21.1° C.), in the Flower Homeopathic Hospital, was 11 per cent. The remarkable fact is also mentioned that when the bath treatment in the Brooklyn Homeopathic Hospital was changed to the more rational affusion practised in the Flower Hospital, the mortality was at once reduced to 11.5 per cent. In the St. Vincent Hospital the late Dr. O'Dwyer obtained still more favorable results by simple affusions with cold water from the cold faucet, and in severe cases with ice-water, a procedure recommended thirteen hundred years ago by Paulus Ægineta as the only rational practice. The mortality in 197 hyperpyrexial cases was 6 per cent.

This valuable report really affords a control experiment unsurpassed in therapeutics. Nor have I noticed any reference to the latter in the numerous works of practice which I have searched for this purpose in the library of the New York Academy of Medicine; they all reiterate the dreary platitudes about the importance of reducing the temperature by the cold bath, by ice-packs, ice-baths, and similar irrational procedures. If such a report had brought forward the fact that a *medicinal* agent had so greatly reduced the mortality of a fatal disease, these text-books would not have omitted to mention it, with the most earnest approval. No more convincing proof can be adduced to demonstrate the

utter unreliability of the text-books on practice as guides in the application of water in disease, nor of the importance of its correct and rational use. How the false teaching of the text-books is perpetuated is demonstrated in the New York Medical Journal, which last spring (1908) offered a prize for the best article of the treatment of sunstroke. Not a single one of the writers of this essay referred to the report of the epidemic of 1896, in which numerous lives were lost by sunstroke, most of which would no doubt have been saved by correct management.

How, then, it may be asked, is the active practitioner to obtain reliable information on hydrotherapy if the standard works of reference do not furnish it? Here he meets a difficulty which I propose to aid in surmounting. All of the special works on hydrotherapy have, until recently, been written by water-cure doctors, whose observations are chiefly on chronic diseases and who rarely see fevers and other acute maladies in which water is a very important and accessible therapeutic agent. Nor does the institution doctor have sufficient opportunity to observe the incipient stages of chronic cases, which are the bane of the family physician, who, when he consults these special works, seeks in vain for precise directions for his guidance, and only after failure to restore the sufferer to health sends him or her to a sanatorium, if a quack or Christian Scientist be not resorted to by the family before he determines to do so.

As a general practitioner I long ago realized this difficulty in my early efforts to follow the French and German special works. They led me to many failures because their methods were too heroic, not clearly individualized, and not adapted to private practice.

There is but one recourse that insures the practitioner against such disillusion and failure, *i. e., to depend only on works written by physicians who, like himself, have experience in general or hospital practice.* They alone are capable of appreciating his utter helplessness when confronted with cases in which water has been successfully applied. Happily there are now several works of this type published in German and English. In these

treatises hydrotherapy is not vaunted as a specific, but as a method of treatment which *aids* in sustaining the failing functions and thus prevents fatal complications in acute disease, and which furthers nutrition and tissue change, the chief therapeutic aims in chronic disease. Such works contain simple directions for home treatment, which in many cases suffice, and in obstinate cases prepare them for institution treatment, and thus shorten the latter.

The study of hydrotherapy would be simplified were it regarded as a method of utilizing the physiologic action of thermic excitation through the medium of water. The rationale of this thermic excitation, conveyed by water to the nerves and vessels of the skin, explains all hydrotherapeutic procedures, and its comprehension and application is not more difficult than are similar facts in the study of drugs. The varying effects of varying temperature, duration and pressure, and technic afford greater latitude in "dosage" than do the effects of drugs, and require more detailed study. That the latter is not difficult, however, must be evident to every general practitioner who utilizes it empirically in the management of the stillborn infant. Sprinkling with cold water is the first and mildest procedure; if this does not act efficiently, he dips the infant alternately into hot and cold water; this is a larger "dose." He does not apply a cold bath to the stillborn infant because it would be too large a dose, nor a cold dip to the typhoid patient because it would be too small a dose of thermic excitation to arouse flagging vitality. There is no time in the obstetric case to ascertain exact temperature; the emergency must be met and the case is immediately terminated. In the typhoid patient, on the contrary, many weary days must be spent in adapting the thermic excitation to the individual case, and exact temperature, duration, and technic are of vital importance. The latter applies to other infectious diseases and to chronic and subacute cases of prolonged duration. It is only necessary to abolish the words "cold water" and "hot water" and substitute thermometric designations and the watch to convert haphazard and disappoint-

ing into a scientific and successful hydrotherapy. Nothing is more simple in medicine, and yet our otherwise more competent writers indulge in vague and discouraging generalities, if not absurdities, when referring to water in therapeutics, as I have endeavored to show.

A change is urgently demanded if we would fulfil the measure of our duty to our patients and to ourselves.

The capacity of water to produce numerous therapeutic effects—stimulant, tonic, sedative, antipyretic, diaphoretic, diuretic, depurative, and evacuant—has led narrow men to erect a medical system—hydropathy. Being based on the fallacy that water is a specific curative agent, it failed, and is now the recourse of empirics who vaunt their successes, but are silent on their failures.

I would fain arouse more attention to the vital fact that physicians are not only suffering material loss by neglecting hydrotherapy, but that in their efforts to ameliorate and cure disease they are sadly handicapped by not applying it frequently.

My colleagues, you are favored in this city by having at your disposal an institution which is ideal in that it is controlled by your own colleague and not owned and conducted by one whose commercial instincts would subordinate the best interests of your patients to his own personal advantage. Another inestimable advantage, as I have learned, lies in the fact that physicians are permitted and invited to observe the treatment, just as they are wont to do in acute cases, under trained attendants. Such observations would convey to you a large fund of knowledge which must inure to you and your patient's benefit. The time demanded for thus watching a case is trivial, because in chronic cases the effect of hydriatic measures is slow, and if personal observation is inconvenient, reports from the trained attendant would place you in possession of the reactive capacity of the patient, his gain or loss in weight, etc. You thus would obtain a guide for the renewal of prescriptions, and add valuable material to the history of each case so treated.

It may interest you to obtain an outline of my mode of

prescribing institution treatment. For cases of defective nutrition or hematosis, idopathic or as a complication, the following has served me well:

R. Hot-air bath until warm, followed by circular douche, one minute, 95° to 90° F. (35°-32.2° C.); pressure, 20 pounds; followed by fan douche for one-half minute at 85° F. (29.4° C.), reduced daily 1 degree; followed by drying and friction, same pressure. Report after three treatments reaction and weight.

This prescription may be abbreviated as follows:

R. H. A. B. w.
C. D., one m., 95° to 90° F. (35°-32.2° C.), 20 lb.
F. D., one-half m., 85° F (29.4° C.), 20 lb.
Fr.
No. 3.

For a case of obesity, chronic rheumatism, gout, or other malady demanding enhancement of tissue change, the prescription may read:

R. Hot-air bath, p. ten min. (to perspire ten minutes).
Circular douche, one m., 100° to 95° F. (37.7°-35° C.).
Fan douche, one m., 95° to 85° F. (35°-29.4° C.).

By these cautious procedures the patient may be gradually restored to health, and the physician, observing the effect of each series of treatment, may increase their number and intensity according to indications in each case.

In conclusion, I desire to emphasize the fact that my observations on the effect of water in disease have been made at the bedside of private patients and in the wards of hospitals for a period extending over a quarter of a century. In a few months I shall pass the half-century mark of my professional career. During the first half of the period I was ignorant of the therapeutic value of water; during the latter half I have endeavored to study and utilize it. Looking back upon this large field of clinical observation I am impelled to offer its results for the furtherance of the interests of the profession I love and honor. Imbued solely by this thought, and without hope or expectation of material benefit,

I come to-night, my colleagues of Boston, to bring to you the message that no agent in the entire *materia medica* has so often demonstrated to me at the bedside such life-saving properties and afforded me such comfort and satisfaction as has the correct application of water since I abandoned the false teachings imbibed from faulty works on hydrotherapy. In acute diseases this was not difficult, because the patient was under the observation of trained nurses, change of technic could be readily made, and the effect observed and recorded. In this manner I was led to abandon Liebermeister's heroic cold bathing and Ziemssen's prolonged cold baths in favor of Brand's brief, sustaining baths; the management of pneumonia by compresses, which have afforded me the best results, also was an evolution from more heroic cold full baths.

From close study and observation of the effect of the heroic procedures recommended by Duval, Keller, Beni-Barde, and others in chronic diseases in the Montefiore Home was evolved my method of neurovascular training (*The Principles and Practice of Hydrotherapy*, published by William Wood and Co., 1908, p. 436), which improves nutrition and hematosis and prepares the patient without shock for more intense procedures adapted to the furthering of tissue changes.

Gentlemen, if I have succeeded in impressing upon you the crying need of the obligatory study of hydrotherapy in our medical schools, and the enormous import of the study and more frequent utilization of hydrotherapy and other physical measures, and if I have succeeded in removing from your minds some of the misconceptions which have crept into this subject, and, above all, if I have convinced you that the grasp of this subject presents no difficulty, but, on the contrary, that the action of water in disease is based on rational principles, I shall congratulate myself on adding to the sum total of knowledge for the alleviation of human suffering.

ELECTRIC PAD, OR THERMOPHORE

This electric device is an aid in many hydrotherapeutic procedures.¹ The pad consists of a special fabric into which German silver resistance wire is interwoven, the whole being covered with mackintosh or eiderdown. The pad is provided with a coil, plug, and rheostat switch. In use it is only necessary to screw the plug into a lamp socket. A turn of the switch makes the connection, and by adjustment of the switch the current may be varied in intensity in the ratio of 1, 2, and 4.



Fig. 145.—The thermophore.

The No. 1 heat is designed for simple, moderate heating effects, as for bed warming, for maintaining the heat of a poultice, or to secure the effects of Bier's method. At this heat the current can be run continuously for hours without overheating the pad. When a higher form is employed, however, a much higher degree of heat is generated, such as is required to produce the intense effects of a fomentation or cause general perspiration. When these heavier currents are employed the pad must be exposed occasionally so as to prevent the excessive accumulation of heat.

When effects identical with those of a fomentation are required, a moist cloth is laid over the skin, over this a dry cloth, and upon this the thermophore. The thermophore has the advantage over the fomentation, the hot-water bag, and similar forms of heating in that the temperature gradually

¹ Designed and manufactured by the Modern Medicine Co., Battle Creek, Michigan.

rises instead of lowering. The fomentation cools off so rapidly that it must be renewed every few minutes, whereas the electric thermophore requires but a single application and may be continued as long as desired. When the heat becomes too great to be borne, it is only necessary to adjust the switch so as to employ less current, and thus the application may be continued without interruption.

Less than one minute is required to bring the pad to the full heat.

The expense is only that of a 16-candlepower lamp light, while the convenience is much greater than with the hot-water bottle, clay poultices, hot-air apparatus, or other of the dirty, inconvenient, and cumbersome apparatus so commonly employed.

For ordinary use the pad is made either with or without the regulating switch. The single heat pad answers very well for ordinary purposes, as the heat can be turned off and on as desired.

ELECTRIC THERMOPHORE BLANKET

These blankets are made upon the same principle as the electric thermophore described above. They constitute a most convenient means for making a general application of heat. They are made with regulating switch, so that any degree of heat required may be employed.

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